Tales of Toxicity

Storylines of Urban Air Pollution

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Preface

This project is inspired by a recent trip, where I had the opportunity to visit several major cities, including Nairobi, Kigali, Cairo, Mumbai, Seoul, Osaka, Tokyo, Vancouver, and Toronto, before finally returning to Copenhagen. During this trip, I was struck by the global nature of car-dependency. In every city I visited, cars were not just present but rampant. In some cities, air pollution caused by these machines was prolific. This caused me to look deeper into the nature of car-dependency where I found Walker et Al.'s paper on `motonormativity'. Within this paper, it is demonstrated that society is willing to a accept higher level harm from cars than from other products due to their perceived role in our society. To dive deeper into this, I have chosen to write my thesis on how storylines change when discussing urban air pollution as it comes from different sources.

I would like to thank my supervisor, Malene Freudendal-Pedersen, for her support and guidance.

Summary

Air pollution is the largest environmental health threat globally and within Europe. Despite enjoying an international reputation as a sustainable and public health leader, Copenhagen is no exception to this problem and is burdened by health and economic impacts of air pollution.

One of the primary causes of air pollution within Copenhagen is road traffic. Cars, partly due to their utility in mobility, and decades of impressive storytelling by the industry, remain a particularly hard source of pollution to address. Cars are so strongly embedded in global culture that Walker et al. (2023) have defined a term to describe the entrenchment: motonormativity. Motornormativity suggests that: "...we have a cultural inability to think objectively and dispassionately." when considering the benefits and drawbacks of the widespread use of private automobiles (Walker, Tapp, and Davis 2022).

A comparison is drawn between two polluting industries, to investigate how motornormativity may impact urban air pollution, uncover industry influences on government, and stimulate dialog on entrenched car-dependency. The stories, condensed into storylines, which different actors use to justify urban air pollution from these sources, are examined within the research question:

> How do national and municipal government storylines addressing urban air pollution from automotive and tobacco sources in Copenhagen align or differ from those of industry?

To answer the research question, the study utilizes an abductive approach, combining a literature review and document analysis to identify and analyse key storylines disseminated by government and industry actors. Three dominant narratives emerged: "Cars are a necessity for life and the economy", predominantly perpetuated by the auto industry and accepted by the national government; "Some polluting products must be 'accommodated' in urban life", conveyed by all actors; and "Combustion is the problem", most strongly conveyed by the tobacco industry and the national government and to a lesser extent by the municipality when referring to automotive pollution.

Legislation and societal restrictions on second-hand smoke from tobacco products are found to be notably more stringent than those for pollution from automobiles, despite the latter causing a magnitude of greater overall harm.

Looking at air pollution from automotive sources, the study finds that the auto industry and Danish government storylines, underpinned by anthropocentric principles, enable

the continuation of the status quo, thereby obstructing substantial change. These positions are found to be heavily influenced by the dominant storylines, which are shown to be primarily created by industry. The City of Copenhagen is found to operate in a middle ground. In response to the dominant storyline "Cars are a necessity for life and the economy", the City has developed a storyline coalition titled, "The Invisible Car" whereby positive stories are relied on as the primary driver of achieving sustainable urban mobility. This storyline coalition aims to make non-polluting behaviours easier through voluntary changes. The City rejects measures which discourage car use, instead preferring to minimize exposure to harmful air pollution rather than address the source.

As it pertains to air pollution from tobacco, the Industry uses storylines which co-opt the appeal to Science. Using selective storylines as an attempt re-insert itself into a movement of 'truth-seeking' which has purposefully rejected them. The industry rejects restrictive regulations described as being based on subjective, unsubstantiated opinions. The Danish government advocates for generational changes, aiming to protect young populations from exposure to second-hand smoke and prevent them from becoming sources of this pollution, urging them not to start smoking. Similar to air pollution from automotive sources, the City relies on voluntary changes, preferring to aid smokers who wish to quit and suggesting, but not legislating, that residents not smoke in outdoor areas nearby children. They are found to actively work against further smoking restrictions in the City – siding with Industry provided dominant storyline: "Some polluting products must be 'accommodated' in urban life".

In summary, industry is found to centrally influence government storylines, potentially resulting in diminished public health outcomes in Copenhagen. This paper advocates for a robust debate to reassess the social acceptability of the public health trade-offs associated with the utility of cars, with a view to influence future policies and societal norms. The study ultimately provides a fresh perspective on urban air pollution narratives, paving the way for further research into effective pollution mitigation storylines.

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1 Introduction and Problem Area

Air pollution is the largest environmental health threat globally and within Europe (CREA 2020; WHO 2022a). The average life expectancy in the European Union (EU) is shortened by eight months due to pollution exposure, where 96% of the population is exposed to toxic air that does not meet World Health Organization (WHO) air quality guidelines (CREA 2020; EEA 2023).

Globally, ambient and indoor air pollution results in over 6.7 million premature deaths annually and systemically reduces the quality and enjoyment of life (WHO 2022a). This is comparable to the public health burden caused by the direct impacts of tobacco smoking, which causes over 7 million premature deaths annually, and much higher than the public health burden of second-hand smoke that causes 1.2 million premature deaths annually (WHO 2022b).

Within the EU, air pollution costs over 4 billion euros in healthcare, 16 billion euros in lost workdays, and in 2020 resulted in over 238,000 premature deaths (European Commission 2022). Beyond human health impacts, air pollution also affects biodiversity and causes property damage (ibid). Air pollution is particularly relevant for cities because they are often centers of human activity and economic growth, and therefore tend to have high levels of air pollution. Cities also have higher population densities, which means that more people are exposed to air pollution. In addition, cities often have unique local conditions that can exacerbate air pollution. For example, the dense arrangement of buildings found in cities can trap pollutants close to the ground, leading to higher concentrations of pollutants and creating hotspots of air pollution that harm public health.

Despite enjoying an international reputation for sustainability and public health leadership, Copenhagen is burdened by significant health and economic impacts of air pollution. Ambient air pollution in the municipalities of Copenhagen and Frederiksberg annually costs the society 4 billion Danish kroner (DKK) (~537M EUR) and has major human consequences such as several sick days, hospital admissions and approximately 550 premature deaths each year corresponding to more than one in ten deaths in the area (J. Brandt, Jensen, and Plejdrup 2013; City of Copenhagen 2023a). For context, car crashes were responsible for seven deaths in 2021 in Copenhagen (Statistics Denamark 2022). Within the Nordics, the air quality in Copenhagen lags behind peer cities such as Reykjavik, Helsinki, Stockholm, and Oslo (IQAir 2022), and breathing the ambient air present in the city of Copenhagen (henceforth, the City) exposes residents to the equivalent of smoking 10.8 cigarettes monthly (Shoot I Smoke 2023).

Notably, these figures only account for ambient air pollution, as described in Figure 1 below, but do not account for the high levels of air pollutants present at a street level.

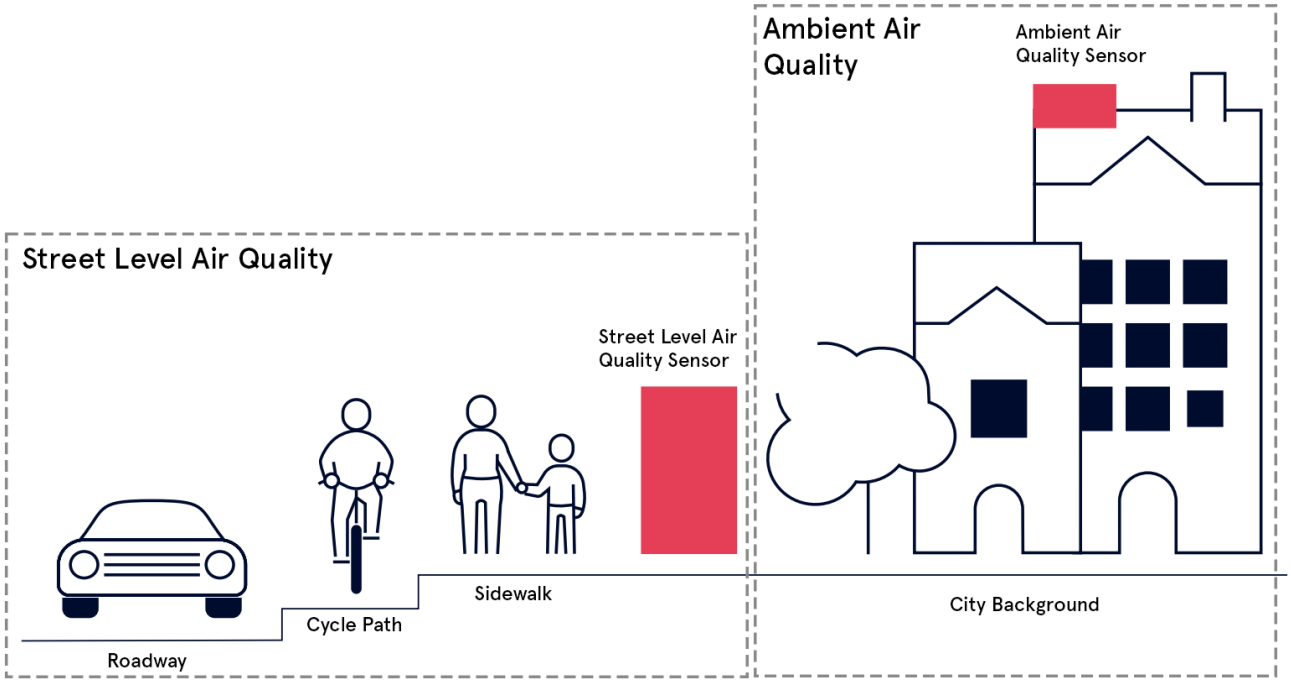

Figure 1: Ambient vs street level air quality, adapted from (City of Copenhagen 2021b)

At the street level, concentrations of tiny particles of diameter 2.5 micrometers or less, called particulate matter ($PM_{2.5}$), are two to five times higher than at an ambient level, and concentrations of ultrafine particles with a diameter of 0.1micrometers or less are one to seven times higher (University of Copenhagen 2020; City of Copenhagen 2021b). $PM_{2.5}$ is particularly harmful to human health as once it is breathed in, it travels to deep parts of the lungs and can enter the bloodstream (CDC 2023). It has been found on the fetal side of the human placenta and in brain tissue (Bové et al. 2019; Li et al. 2022).

Quantified public health impacts similarly do not include emerging pollutants such as ultrafine particles or black carbon (BC) which are believed to be associated with the observed excess mortality of 300-500 deaths among residents alongside roads with heavy traffic in Copenhagen (The Danish Ecological Council 2014). In the City's own words:

> *"... it can be concluded that the health consequences of air pollution in Copenhagen should be understood in the context of the fact that the health consequences are* ***far greater than the assumptions in the existing calculations****, and that people are therefore already aware today that the health consequences must really be expected to be significantly large"* (City of Copenhagen 2021b) emphasis added by author.

Summarized quite simply "The air is not as clean as we think." (City of Copenhagen 2023a).

Despite this, clean air is a top priority for residents. In a survey from 2018 two thirds of Copenhageners said that clean air is important or crucial to how attractive the city is, and one third think the municipality should prioritize clean air highest out of a total of 31 factors that makes a city attractive to live in (Copenhagen Solutions Lab 2023). Yet, addressing this pollution remains elusive and an unsolved problem.

So, what is air pollution, and how widespread is it really?

1.1 Defining Air pollution

Air pollution refers to the presence of harmful substances in the air that we breathe. These substances can come from natural and human-made sources and negatively affect human health, the environment, and climate. Some common examples of air pollutants include:

- Particulate matter (PM): tiny particles that can be released from sources such as wildfires, vehicle exhaust, and power plants. These are usually classified into PM_{10} and $PM_{2.5}$, respectively referring to the diameter of the particles. PM_{10} is 10 micrometers or less in diameter and $PM_{2.5}$ is particulate matter 2.5 micrometers or less in diameter. Ultrafine particles, or $PM_{0.1,}$ are of a nanoscale size and have a diameter of 0.1 micrometers or less.
- Nitrogen oxides (NO): gases that are produced from combustion processes, such as those in cars and power plants. The most common nitrogen oxide is NO_2, nitrogen dioxide.
- Carbon monoxide (CO): a gas that can be released from sources such as vehicle exhaust.
- Ozone: a gas that can form when nitrogen oxides and volatile organic compounds (VOCs) react in the atmosphere, often as a result of human activities. Ozone found in the stratosphere helps to protect the earth from harmful UV rays; however, when inhaled, it reacts chemically with many biological molecules in the respiratory tract, leading to a number of adverse health effects (US EPA 2016).
- Sulfur dioxide: a gas that can be released from sources such as power plants and industrial facilities.
- Black carbon: is PM soot formed by the incomplete combustion of fossil fuels and biomass. It is mostly emitted by vehicles, non-road mobile machineries such as ship or industrial biomass combustion, and wood burning stoves in homes (EEA 2013).

1.2 Sources of Urban Air Pollution

Within Europe, the singular largest source of air pollution is traffic (EEA 2023). Over 64% of all reported exceedances of WHO air quality standards were linked to dense traffic in urban centres and proximity to major roads (EEA 2023), and traffic is responsible for one quarter of particulate matter in the air (Degraeuwe et al. 2019). Within Denmark, road traffic represents the only major source of exceedances reported (i.e., road traffic causes 100% of the air quality exceedances) (EEA 2023).

In the City, road transport is the largest emission source for nitrogen dioxides (53% of the total), followed by cogeneration and district heating plants (28%), while wood burning (non-industrial combustion) is the largest source of both PM_{10} (33%) and $PM_{2.5}$ (46%) (Aarhus University 2021 as cited in City of Copenhagen 2021b).

At a basic level car traffic releases emissions via exhaust emissions from the combustion process, brakes and tires degradation that leaves behind particulate matter, re-suspension of PM by surface agitation, and fuel evaporates from spills or improperly sealed fuel tanks. These sources result in the production of toxic air, which is especially prolific in urban areas and among major thoroughfares.

Despite that traffic has been known as a central contributor to urban air pollution for decades, the problem remains. This raises interesting questions about the role of cars in society.

1.3 Motonormativity, Car Culture

Upon a recent trip encompassing several cities across the globe, the researcher was struck by not only the differences between the cities found in Europe, Africa, South Asia, Asia, and North America but the similarities. Globally, the car has revolutionized mobility and is one of the defining inventions of the 19th century. It is perhaps no wonder then that cars have been universally, with a literal handful of exceptions, become to define the urban fabric of our cities. This seemingly obvious remark may belay the depth to which this phenomenon occurs.

Cars are so prevalent in global society that they have become synonymous with mobility, clouding our collective ability to objectively address much needed reforms. As Sheller (2004: 236) writes:

> *"Cars will not easily be given up just (!) because they are dangerous to health and life, environmentally destructive, based on unsustainable energy consumption, and damaging to public life and civic space. Too many people find them too comfortable, enjoyable, exciting, even enthralling. They are*

deeply embedded in ways of life, networks of friends and sociality, and moral commitments to family and care for others".

So, the phrase goes, "if all you have is a hammer, everything looks like a nail". Global society has so deeply entrenched the car as the dominant tool to address mobility that our mobility solutions have become tailor fit for the movement of *cars*, rather than the movement of *people*. This concept is illustrated in the satirical comic below in Figure 2.

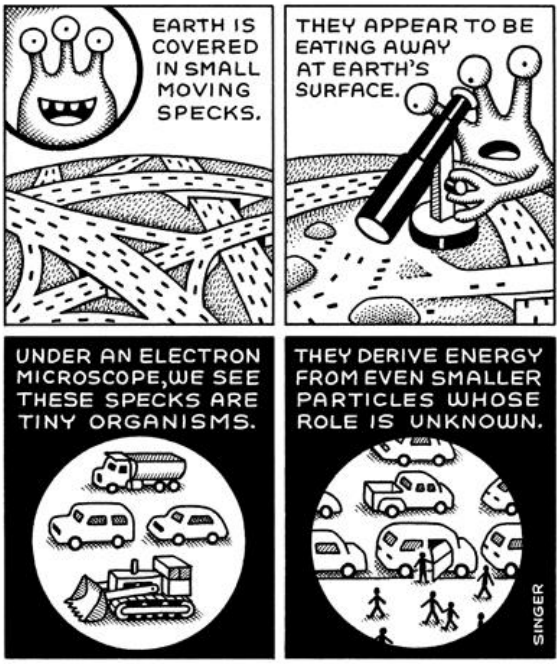

Figure 2: Global Car Culture (Singer 2022)

This phenomenon has been recently termed "motonormativity" by Walker et al. (Walker, Tapp, and Davis 2022). The existence of a motonormative culture is evident when we critically examine some of the cultural notions around driving. For example, the legal speed limits for motorists are commonly thought of as speed minimums and, as such, are frequently exceeded. When we examine the language used to enforce these maximums, we come across terms such as 'speed traps', implying some sort of deceit. Mobile applications such as Google Maps, Trapster, and Waze, provide the locations of such 'traps' to allow drivers to evade them. The premise being that these sorts of laws arbitrarily constrain the freedom of motorists to rapidly move from one point to another. Oddly enough, the same rules do not apply to other laws. Security measures installed at banks, for example, are not termed 'theft traps', nor does society socially stigmatize exceeding the speed limit in similar ways to other behaviours such as graffiti, shoplifting, and smoking in no-smoking zones.

Walker et al. have further explored the prevalence of motonormativity by exploring responses to public opinion surveys where two forms containing the same underlying

principle are presented. For example, by changing a single word on a question about risk as a function of *working* vs *driving,* Walker et al. demonstrate that the public is much more willing to accept health risks when they stem from driving. Figure 3 explores this further by presenting several questions with the same underlying principle in an automotive and non-automotive context.

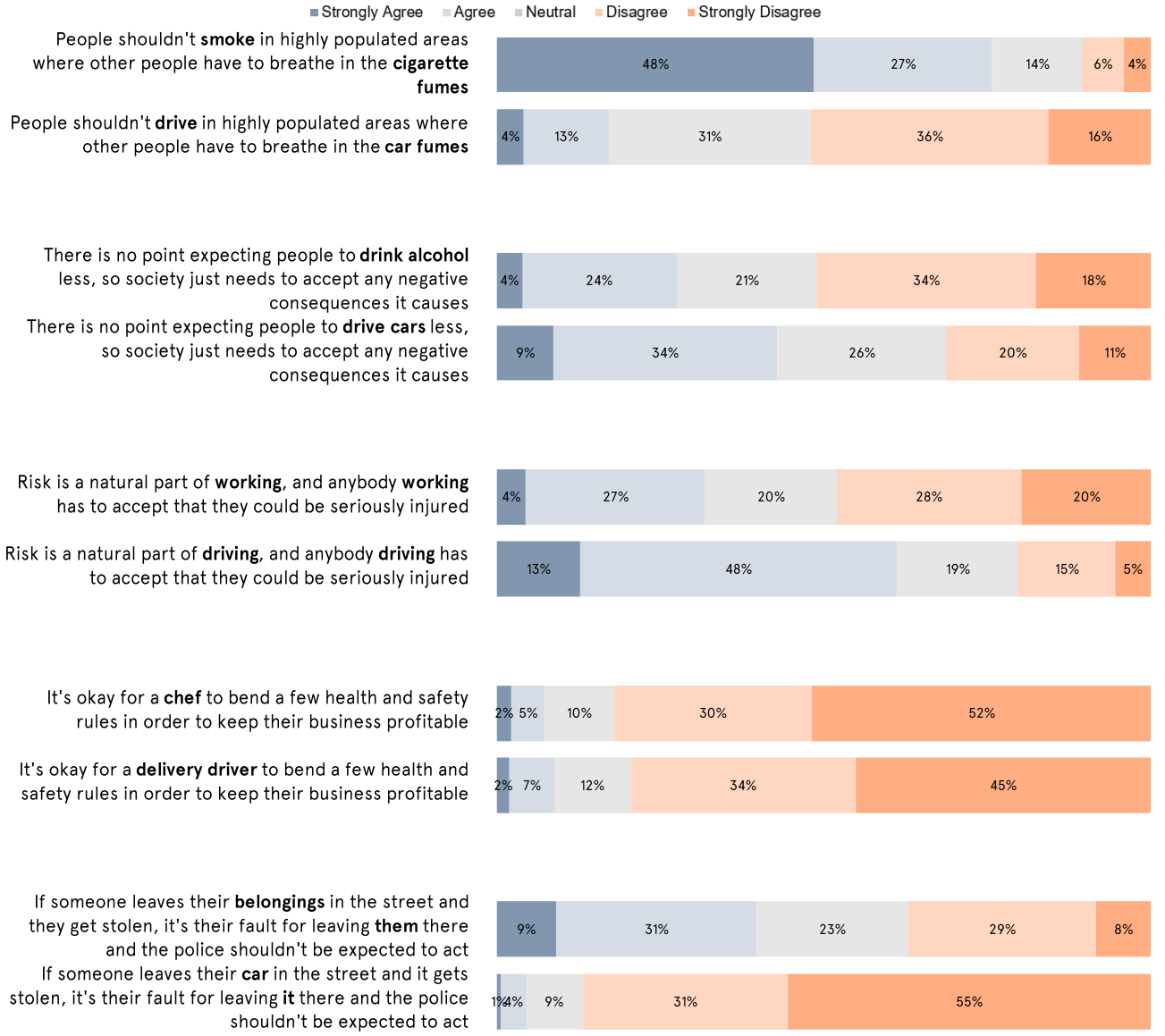

Figure 3: Motonormativity (Authors figure, adapted from Walker et al.)

As demonstrated by the responses in Figure 3 above, it becomes clear that society is willing to accept different and higher levels of risk then they might otherwise, if and only if it relates to cars.

Motonormativity can help explain why, despite most European citizens identifying the health impacts of air pollution as a very serious problem, they consistently present public opposition to measures restricting road traffic (Data Europa 2019; EEA 2023). The

manufactured inability of the public to consider mobility beyond moto-mobility means that these policies are often regarded as an institutional attack of freedom.

Thus motonormativity "...systematically distort(s) medical and policy decisions" (Walker, Tapp, and Davis 2022), which is especially relevant in the issue of urban air pollution sourced from traffic.

1.4 Polluting Products

The concept of motonormativity describes the complex socio-technical relationship that exists between society and cars and suggests a possible reason why urban air pollution stemming from cars is uniquely hard to address.

However, cars are far from the only polluting product sold which has complex socio-technical relationships with society. Other products similarly produce toxic air and take a toll on society. However, the largely unrestricted use of these polluting products has been revoked in the name of public health.

This is referring to tobacco products, which when used as directed kill over half of its users resulting in over 13,600 deaths every year in Denmark (NCD Alliance 2015; Sundhedsstyrelsen 2023a). Additionally, smoking releases a slurry of harmful pollutants to the surrounding air, typically referred to as second-hand smoke or passive smoking. This pollution is known to cause approximately 900 deaths in Denmark, corresponding to more than 90 deaths in Copenhagen annually (Sundhedsstyrelsen 2023a).

Compared to other sources of poor air quality, which harm many more citizens, protecting against exposure to second-hand smoke has resulted in legislated access restrictions alongside several other restrictions placed on the industry, for example in advertising.

This comparison brings about a number of interesting converging and diverging parallels which will be explored further below.

2 Research Question

Stories have always formed a key basis in argumentation. Decades of impressive storytelling by the auto industry have ushered in an era of motonormativity and made private automobile use a particularly hard source of pollution to address. The tobacco industry has similarity used stories to challenge the growing resistance to the public health burden that their products cause. These stories are then adopted, or challenged, by governments who regulate these products. To better understand how these stories permeate government institutions this paper will investigate:

> How do national and municipal government storylines addressing urban air pollution from automotive and tobacco sources in Copenhagen align or differ from those of industry?

To aid in answering this research question the following sub-questions will also be explored:

SQ1: What are the dominant storylines and how do these implicitly shape storylines used by different actors?

SQ2: Do any of the storylines employed give a deeper understanding into the actor's internal understanding of the role that private automobile use or tobacco products occupy in society?

2.1 Scope

Automotive and tobacco are both industries which produce products that pollute. They are also both global in nature with a handful of companies controlling the majority of the international market. The top ten automotive companies control 48.6% of the market (Carlier 2022), and just four major transnational tobacco companies controlled approximately 69% of the global market (excluding China) in 2008 (S. Lee, Ling, and Glantz 2012).

To answer the above research question, this report will speak to the specifics of these industries within Copenhagen, and Denmark but as both industries are globalized, pull in references from European or international sources where appropriate.

2.2 Positionality Statement

It is important to acknowledge that the author, while endeavouring to be a neutral and objective researcher has inherent biases and impartialities. The positionality of the author is based on their world view and the position they adopt about a research task and its social and political context (Darwin Holmes 2020).

Simply put, a masters student studying Sustainable Cities while working as a Climate Analyst and politically left leaning while living within the context of a welfare state cannot be considered as a neutral or impartial. While every attempt has been made to be reflexive, the author hopes that the reader can consider his positionality when approaching this thesis.

3 Theoretical Framework

Informed by Hajer's (2006) theory of argumentative discourse analysis, this paper will identify and analyse a subset of the discourse which surrounds the controversy of urban air pollution from both automotive and tobacco sources. This subset of the discourse is narrative in the form of storytelling, and more specifically, storylines as defined below.

3.1 Story Telling and Storylines

Stories understood through storytelling have always occupied a central role in human culture and history. In an urban planning context, the way that stories are narrated ultimately becomes constructive of urban reality and much of urban planning can be understood to be performed through story (Sandercock 2003).

Copenhagen for example has used storytelling to create an aspirational identity of the Copenhagener, one who bikes to get around. This identity has co-evolved with the rise of cycling infrastructure in the city and created the sustained public support needed to maintain a cycling culture. The transformation into a cycle city is largely considered a success, with over 49% of commuter trips being performed by bike and being rated the world's top cycling city several times, most recently in 2019 ("Copenhagen's Bike Culture" n.d.).

To bring about this change, Copenhagen has used effective communication to brand itself as "The Best Cycling City in the World" (City of Copenhagen 2023b). This phrase an example of a storyline. A storyline can be described as "...a condensed statement summarizing complex narratives, used by people as shorthand in discussions." (M. A. Hajer 2009).

It is well understood that ecological sustainability in of itself is not a driving force behind behaviour change in within urban mobility yet (PPMC 2015). Instead, much of Copenhagen's success in achieving a more sustainable urban mobility is due to their strategy being based on positive communication that does not mention motorized vehicles or environmental challenges such as climate change (Gössling 2013). Instead, the storylines chosen focused on the benefits of bicycles, such as greater average speeds and better health (ibid).

Storylines are sufficiently vague to unify diverse perspectives, while retaining a central theme. For example, Copenhagen is not "the bike lane city", or the "no on-street parking" city, but rather "The Best Cycling City in the World". This allows storylines to work for a number of actors who may be opposed to more specific measures (M. Hajer 2006).

They also act as a compressor of discursive complexity (Brink et al. 2006). In this example, sustainable urban mobility (SUM) is a wide-ranging field encompassing public transit, remote working schemes, urban planning laws and regulations (zoning etc.), and an abundance of other sectors. The City in this case has chosen to specifically address a subset of the discourse around SUM. This framing, leading to the storyline ("The Best Cycling City in the World"), leads to a specific outcome. The process of creating storylines narrows both the input and outcomes, a process visualized below in Figure 4.

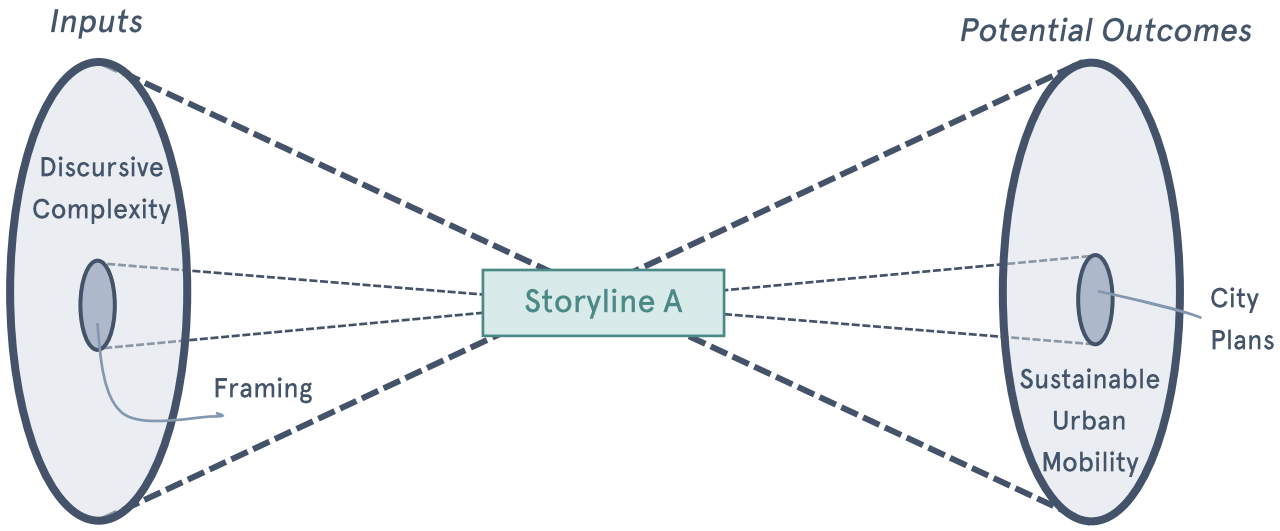

Figure 4: Schematic representation on how of storylines narrow input and outcome (Authors)

Therefore, the framing and storylines used to bring about change are critically important, and not merely value-neutral words used to describe a process. Further described by Brink, 2006 "Language profoundly shapes our view of the world and reality, instead of merely a neutral medium mirroring it" (Brink et al. 2006).

Leaning on this theoretical understanding, revealing the storylines used by industry and government will allow for a better understanding of controversies within urban air pollution. Not in technical or rational-analytical terms, but in terms of argumentative rationality as defined by rational argumentation theory. Simplified, this theory postulates that actors need to convince (and to be convinced) in a rational way and this is possible only by means of justification (Aarnio 1997, 96; Alexy 1989, 214; Golding 1984, 4–5; Peczenik 1989, 123, 211–2; 1995, 676–98; Wróblewski 1992, 209–14, 240–1 as cited in Paso 2014).

The stories that actors tell, condensed into storylines, are the medium in which this justification occurs. These storylines will be examined to determine what is being said to whom, in what context, and if relevant the specific linguistic choices in which the message is structured.

3.2 Storyline Interaction

These storylines will be examined from diverse actors, and how they interact will form a key basis for responding to the research question. These interactions are identified using the following definitions inspired by Hajer (2006).

> **Storyline Affinity:** arguments that have very different roots and meanings but together uphold a particular way of seeing (M. Hajer 2006)
>
> **Storyline Coalition:** ensemble of particular storylines, the actors that employ them, and the practices through which the discourse involved extern their power (M. Hajer 2006).

Identifying instances of storyline affinity and coalition provides conceptional tools in which to analyse how interests and biases are presented by different actors (M. Hajer 2006).

Identifying storyline coalition allows for analysis into how interests are negotiated within specific actors and organizational practices, rather than referring to interests in isolation. It recognizes that actors perceived interests are embedded within larger institutional contexts, and these interests are expressed through specific storylines and practices. Therefore, this approach enriches the analysis of controversies by providing a deeper understanding of their broader political context (M. Hajer 2006).

This approach also sheds light on the roles different actors and practices play in either perpetuating or challenging existing biases and cultural norms. It underscores that these actors or organizations don't necessarily have to work in coordinated ways or share profound values to influence bias. This underlines the complex, multi-faceted nature of

stories, which can be shaped by a diverse range of actors and practices, often working independently but contributing to a common outcome (M. Hajer 2006).

Storyline affinity and coalition can occur within the same actor with a collection of storylines, or across different actors who share storylines or collections of storylines.

Taking inspiration from discourse analysis practice and theory provided by Hajer 2009 this paper will preform a storyline analysis. These storylines are the justifications demanded by rational argumentation theory as defined by Paso 2014 and will provide an understanding of different actor's internal views on these polluting products and the role that they understand them to occupy in society.

3.3 Dominant Storylines

When analysing storylines from diverse actors, including powerful transnational companies and national or local governments, a link between power and dominance must also be considered (M. Hajer 2006). Afterall, even a compelling story holds no power if the actor telling it cannot command an audience. Therefore, the analysis will also identify storylines with a powerful influence, hereafter called dominant storylines.

A storyline is said to be dominant if it exhibits a high degree of structurization and institutionalisation following the below definitions inspired by Hajer (2006).

> **Storyline Structurization**: When a storyline starts to dominant the way a given social unit (a policy domain, a firm, a society, etc.) conceptualises the world (M. Hajer 2006).
>
> **Storyline Institutionalisation**: The solidification of structurization within institutional arrangements (M. Hajer 2006).

To measure the influence of any particual storyline, the extent to which diverse actors use it to concuptulise the world (structurization), and to what degree is solidifies into institutions and organisation practices (institutionalisation) is then measured. If a storyline has strong elements of both concepts, it is considered dominant.

In politics, storylines are typically mixed from several sources and in most cases, there is not one dominant storyline which defines all those that follow it. Yet, there is often a storyline which holds a particular claim to power (M. Hajer 2006). These dominant storylines heavily influence the framing of other less powerful storylines.

4 Methods

To answer the research question, a combination of literature review and document study, facilitated through coding, is employed. The two methods are used abductively to ensure a deep understanding of the subject matter. This approach allows the researcher to move between in depth vertical studies of specific documents while further contextualizing the results with supporting horizontal literature reviews. As urban air pollution is a rapidly evolving field, please note that the research in this paper is up to date as of April 2023. Any developments which may have occurred since then are outside the scope of this research. The research was conducted according to the following steps:

1. **Literature Review**
    a. Obtain an in-depth knowledge of the current understanding of the problem
    b. Identify relevant actors and documents to study
2. **Document Study**
    a. Identify codes from a subset of the collected documents
    b. Code the entire corpus of collected documents, adding any relevant codes not present in the initial data subset
    c. Review entire dataset to ensure cohesion in code selection and identification
3. **First Analysis**: gather the codes and write initial analysis of findings
4. **Second Analysis**: preform another literature review, specifically looking at the codes found and bringing in supplemental data, broadening the first analysis.
5. **Theoretical discussion**: leaning on the theory described above, observe how the collected storylines interact and note those which are dominant.

This process is further visualized below in Figure 5.

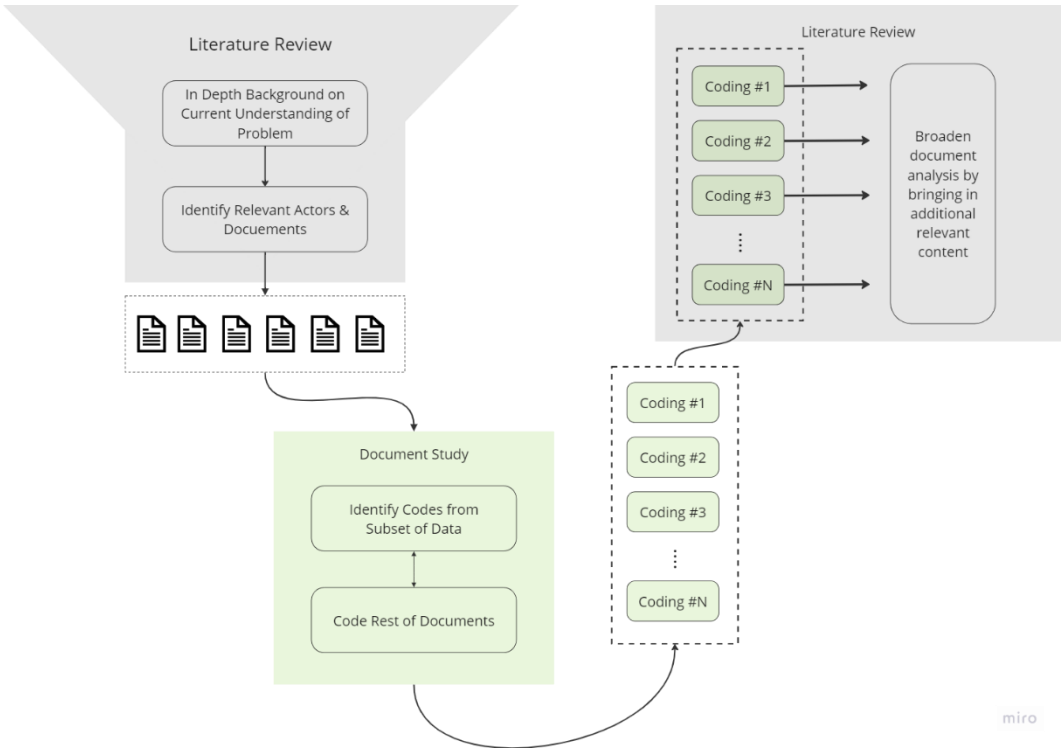

Figure 5: Visualization of research process

4.1 Literature Review

To gain a thorough understanding of the discourse surrounding air pollution from automotive and tobacco sources, a systematic literature review was carried out. A literature review is an examination of the current level of knowledge in a specific area, and it is crucial for any research endeavour that seeks to expand upon the existing body of work. When performed meticulously, it can establish a foundation for the progression of knowledge and the facilitation of theory evolution (Webster and Watson 2002; Snyder 2019)

The objective of the literature review is not to achieve a complete understanding of research on air pollution from automotive and tobacco sources, but rather to ensure that this research embraces various perspectives, and to build understanding to formulate a conceptual model of the sector.

Literature related to the emissions from vehicles and tobacco, global, European, and Danish, pollution policies, the health and environmental impact of these sources, and the role of automotive and tobacco companies in the sector were examined. Sources encompassed academic articles, newspaper pieces, policy documents, as well as reports from leading authorities on the subjects (WHO, EPA, EU, etc.). Over one hundred documents were reviewed to provide the researcher with an extensive understanding of urban air quality as it relates to tobacco and vehicles and the challenges it faces.

4.2 Document Study

During the literature review several prominent actors have been identified, including those listed in Table 1 below.

Actor	Basis for Relevance
Ministry of the Interior and Health	In charge of a wide range of public health related issues.
Ministry of Transport	In charge of developing and maintaining Danish transportation infrastructure
Ministry of Climate, Energy and Utilities	In charge of state climate change efforts, highly liked to air pollution in urban areas
City of Copenhagen	Studied municipality
Dansk Industri [Danish Industry]	Advocates for the business interests of Danish industry
Tobaksproducenterne [The Tobacco Manufacturers]	Industry group for tobacco manufacturers in Denmark
De Danske Bilimportører [The Danish Car Importers]	Industry group for automobile importers in Denmark. Note: Denmark has no national automobile industry
European Smoking Tobacco Association (ESTA)	European Industry group for producers of smoking tobacco
European Automobile Manufacturers Association (French: Association des Constructeurs Européens d'Automobiles; abbreviated ACEA)	Definitive European Industry group for car manufactures, representing the 14 major Europe-based automobile manufacturers.
Phillip Morris Aps & Phillip Morris International (PMI)	Leading global tobacco and tobacco product sales company. Highly influential for the tobacco industry as a whole.

Table 1: Prominent Actors

Documents from these actors were then selected on the basis of relevance to the research question. Documents were identified through a comprehensive web-based search searching for key terms in Danish and English including, but not limited to, "Urban Air Pollution [Copenhagen], Air Quality, Auto Industry Groups Denmark/Europe, Public health impacts of air pollution in Copenhagen, Public health impacts of tobacco use in Denmark/Copenhagen".

The following documents have been selected for the documents analysis:

Actor	Tobacco	Automotive
Government ***National***	Ministry of the Interior and Health, Denmark Smoke-free Environments Act (2007) Changes to the Danish Act on Smoke-free Environments (2012)	Denmark Forward: 2035 Infrastructure Plan Sammen om en grønnere fremtid Klima- og lufudspil [Together for a greener future, Climate and Air], 2018

Government ***Municipal***	Press Release "Danmarks hovedstad skal være røgfri" (Denmarks Capital must become smoke-free) Smoke-free Copenhagen 2025, City of Copenhagen Website	Yearly report on Air Quality 2021, City of Copenhagen
Industry	Health Advocacy, European Smoking Tobacco Association In The Media - Tobaksproducenterne Health Impacts of Smoking - Phillip Morris Aps (Denmark)	Passenger cars: what they are and why they are so important – ACEA Air Quality – ACEA Fossilfri byer kan koste bilejere og virksomheder dyrt [Fossil-free cities can cost car owners and companies dearly] - Dansk Industri Transport Euro 7 Impact Assessment: The Outlook for Air Quality Compliance In The Eu And The Role Of The Road Transport Sector - ACEA New 'Euro' pollutant emission proposal risks slowing down transition to zero-emission transport - ACEA Is the EU playing with our net zero future? - ACEA

Table 2: Identified Documents for Document Study

4.3 Coding

Coding is used to analyse the data collected. Coding describes the process of labelling, assigning, and organizing pieces of information with the aim to identify different themes and the relationships between them (Medelyan, 2019; Van Thiel, 2014). The qualitative data analysis software tool called NVivo was used to code the documents.

The following codes have been identified through an abductive research process whereby the researcher is informed by both practice as well as a theory, this process is contrasted by an inductive and deductive approach below in Figure 6.

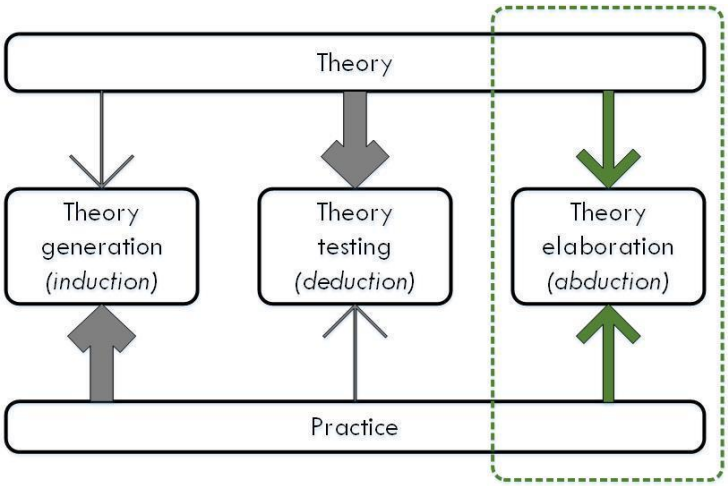

Figure 6: Abductive research approach (Costa, Soares, and Pinho de Sousa 2017)

In concrete terms, the author who has a knowledge of sustainable urban mobility and urban air quality, read a subset of the identified literature, found common themes and arguments (thus identifying codes), then coded the remaining documents. Through the remaining documents, any additional codings found to be relevant were added.

After which, the entire corpus of identified literature was re-read using the entire library of identified codes. Through this process, the following codes have been identified.

4.3.1 Shift Responsibility

This storyline aims to shift responsibility to external factors, such as suppliers, regulatory agencies, consumers, cities, other stakeholders, or simply no one, to minimize accountability. It may focus on the complex nature of the problem, for example stressing the need for multi-stakeholder engagement, suggesting that it is other stakeholders who must lead with meaningful action. The coding can also be used to describe urban environmental pollution as a phenomenon which simply happens. In this argument there is no causal agent for environmental degradation; so, no stakeholder can be responsible, effectively shifting the blame to no one.

4.3.2 Vulnerable Populations

Certain populations have an increased susceptibility to the harmful effects of air pollution than others, as seen in Table 3. This coding identifies where actors have used these populations in their storylines.

Population	Reasons for Vulnerability
Children	Developing lungs and immune systems, higher breathing rates
Older adults	Age-related declines in lung function, chronic health conditions
People with pre-existing health conditions	Chronic respiratory or cardiovascular diseases, weakened immune systems

Pregnant women	Increased risk of premature birth, low birth weight, developmental issues
Low-income communities	Proximity to pollution sources, limited access to healthcare
Outdoor workers	Higher exposure to air pollution due to nature of work

Table 3: Vulnerable populations

This coding can be seen both in written form and visually in the selection of pictures utilized for visual media. This coding is typically used to call for increased protection of these populations but can also be used to show the safety or efficacy of a proposed solution to reduce air pollution.

4.3.3 Minimization

To employ minimization is to downplay the severity or impact of the issue, suggesting it is an isolated incident or the consequences are insignificant. It is important to note that some actors employ minimization through avoidance, and the below analysis will also identify where actors have chosen to minimize the problem to the extent that it is dismissed as irrelevant, and therefore not discussed.

Minimization has also been identified in subtle uses of language, such as through the presentation of 'risk'. As risk is defined as "possibility of loss or injury" (Merriam Webster 2023) it implies that there is also a possibility of no harm. In short: risk is a possibility, whereas harm is a certainty. Therefore, discussing exposure to air pollution as a *risk* to health is an inaccurate characterisation of the *harms* that these pollutions pose. As is stressed in the WHO Global Air Quality Guidelines, **no safe level of air pollution exists** (K. K. Lee et al. 2020; 2020; Orellano et al. 2020; Orellano, Reynoso, and Quaranta 2021; Chen and Hoek 2020; Huangfu and Atkinson 2020).

4.3.4 Socioeconomic Threat

A socioeconomic threat has been defined as the argument that action, or inaction, on an issue may have significant impacts on an individual's or a community's well-being, stability, and prosperity. These impacts may be through forms such as unemployment, loss of liberty, mobility inequality, loss of freedom, loss of economic competitiveness on an individual, regional, or global scale.

4.3.5 Tech Solutionism

Tech solutionism argues that that technology will advance sufficiently such that a problem is fixed or sufficiently alleviated. This storyline gives agency to technological and scientific advancements as the core solutions to address concerns, where the problem diagnosis can be summarized as a 'lack of technology', and the solution to this, optimization, increased uptake of new products, and research and development.

4.3.6 [Industry] saviour

The [Industry] saviour storyline is adapted from Supran and Oreskes (2021) "fossil fuel saviour" storyline. This storyline describes the way fossil fuel companies have positioned themselves as the natural and necessary suppliers of global energy who simply 'meet demand' and provide selfless methods for filling gaps during the energy transition. The storyline normalizes fossil fuel's role in the present and future of solutions, describing the inevitability (and therefore implicit acceptability) of climate change.

This approach can be mirrored in other industries, such as the automotive or tobacco industry to argue that they are similarly justified in meeting demand for their products. [Industry] savior allows actors to separate themselves from the negative consequences of their actions by presenting a scenario where no other alternatives are feasible.

*4.3.7 The Scientific Evidence**

The Scientific Evidence* is a storyline in which actors use an appeal to science as the basis for legitimizing a particular stance or activity. Science is widely respected and considered a reliable source of knowledge about the world, often based on empirical evidence and objective observation, as opposed to subjective opinion or belief. An appeal to science often infers broad consensus as science is usually based on wide availability of high-quality evidence. However, actors can also employ this coding irrespective if the appeal is based on an accurate representation and understanding of the science involved. This is noted in the name of the coding, The Scientific Evidence*, where the asterisks denotes that the reader must carefully read the 'fine print' and evaluate claims presented with a critical stance.

4.4 Methodological Limitations

Document study, literature review, and coding each have their own established methodological limitations. Document study can face issues such as limited access to documents, concerns about the authenticity and accuracy of the documents, inherent biases, and a lack of contextual understanding (Labaree 2022). Literature review, on the other hand, can be affected by publication bias, a limited scope that might miss relevant studies, reliance on potentially outdated information, and the varying quality of included studies (Haddaway 2020). Coding can be subjective, potentially leading to inconsistencies and biases (Illinois Library n.d.). Even when descriptions of codes exist, there continues to be significant debate about what constitutes reliability and rigour in relation to qualitative coding (Roberts, Dowell, and Nie 2019). This makes it difficult for researchers to effectively replicate analysis strategies and processes, and to fully understand the rigour of the study (ibid). Additionally, although every attempt has been made to provide

clear boundaries of the codes, there exists the potential for overlaps between them, potentially impacting the analysis.

Beyond these established limitations, the researcher, a recent immigrant to Copenhagen, posses only a rudimentary grasp of Danish. Given some documents pertaining to the studied area are only available in Danish, use of automated translating tools such as Google Translate, and DeepL were employed. As the analysis relies on language-based codes, this may present difficulties when studying multilingual data sets. It is possible that due to this limitation, specific cultural or linguistic facets have been missed, for example not searching for a specific keyword in Danish, and thereby missing potential material for the literature review, or document study.

Efforts have been made to minimize these limitations however they can affect the reliability and validity of research findings, so results should be interpreted with this in mind.

5 Research Design

The research will be undertaken according to the following schematic, seen in Figure 7 below.

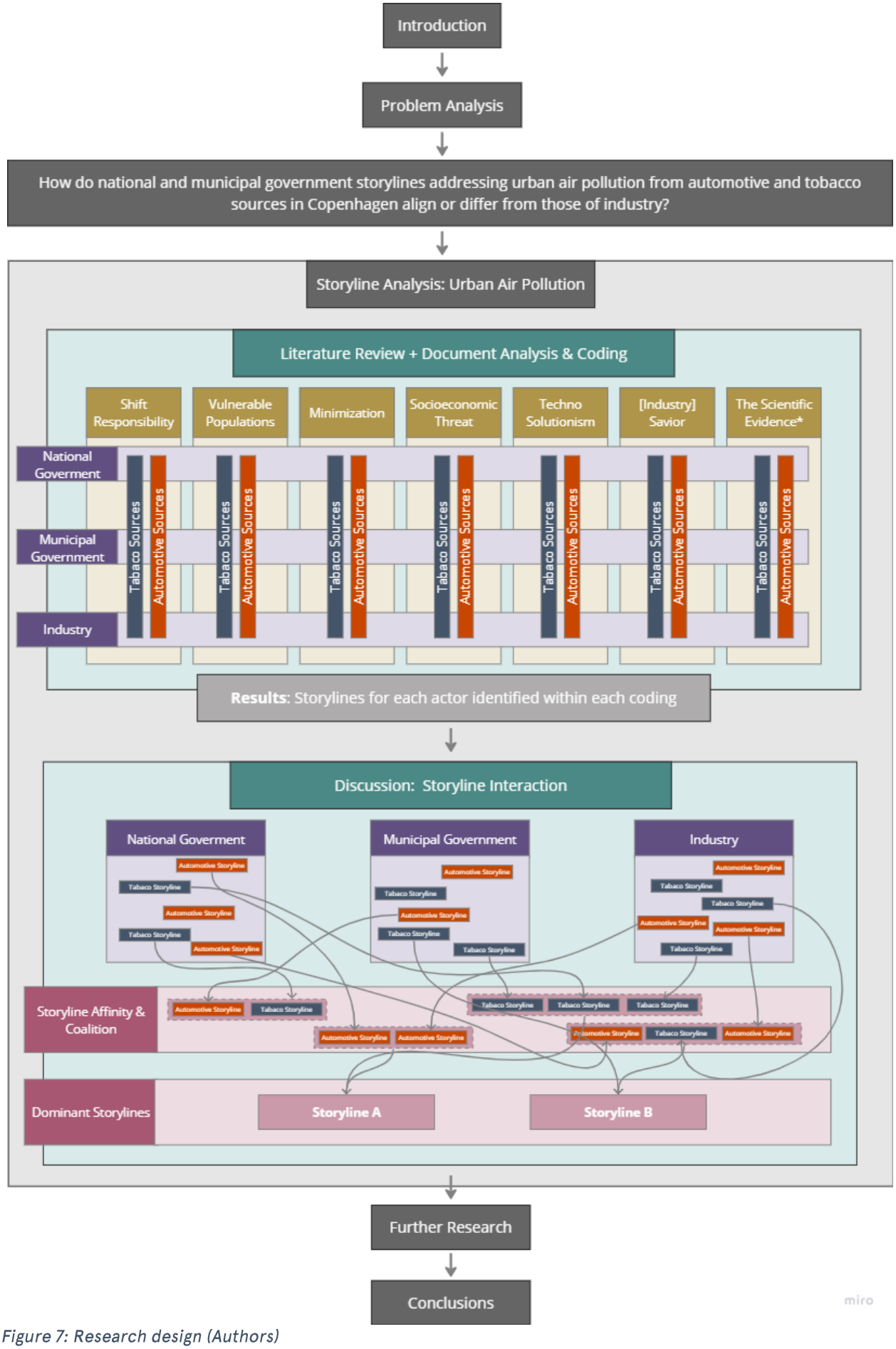

Figure 7: Research design (Authors)

6 Storyline Analysis

The following chapter contains the analysis of the data gathered. The arguments found in the documents analysis are first grouped into codes as defined in the methodology. After, the analysis under each coding is broadened with additional literature review. Finally, at the end of this section all actor's storylines are summarized under each coding and as they relate to urban air pollution from tobacco and automotive sources.

6.1 Coding

After the data was coded, the discussion under each code is broadened horizontally by incorporating relevant information found through abductive literature review. The following codlings are presented in order from most employed to least across all actors.

6.1.1 Shift Responsibility

The shift responsibility storyline is the most used storyline. This coding covers the ways in which industry and government sources subtlety, and occasionally overtly, shift the burden of responsibility to other actors. This tactic has a rich history and is widely adopted across polluting industries (Motavalli 2021). Including for example, the creation of the concept of a `carbon footprint' whereby UK-based Oil & Gas giant Beyond Petroleum (BP) created a campaign which pushed the idea that consumers bear the responsibility for the greenhouse gas emissions from their use of BP's sold oil and fossil gas (ibid). Several relevant quotes from this coding can be seen below in Table 4.

Actor	Tobacco	Automotive
Government – National	NA	NA
Government – Municipal	A smoke-free capital by 2025 - on a voluntary basis and without pointing fingers. (City of Copenhagen 2022b)	The recommendations are that citizens can advantageously reduce exposure to air pollution by choosing roads with less traffic and avoiding rush hour when moving around Copenhagen.(City of Copenhagen 2021b)
Industry	Non-smokers should not be involuntarily exposed to tobacco smoke in enclosed, indoor public spaces. (ESTA 2023) The public must be informed of these conclusions [passive smoking is harmful	All sectors need to contribute to help reduce the level of ambient air pollutants and road traffic will continue to make important contributions as part of an integrated and coordinated approach dealing with both air emissions and greenhouse gas emissions. (ACEA 2013) Our net zero future hangs in the balance — and the positive momentum of the EU

	and causes cancer among other harms] and be guided by them so that they can decide whether they want to be in places where second-hand smoke takes place or, if they are smokers, where and when they should smoke when they are together with other people. Smokers should not smoke near children and pregnant women. (PMI n.d.) A balance can be achieved by ensuring smoke-free environments for non-smokers whilst also accommodating smokers with designated, ventilated smoking areas. (ESTA 2023)	Green Deal is grinding to a halt — while policymakers are set to debate a proposal which threatens to leave us without an effective policy approach focused on decarbonising road transport. (ACEA 2023a) However, further reductions in VOC emissions (notably from the 'solvent and product use' sector) is predicted to result in ozone reductions and improved compliance across the EU. (Aeris Europe 2021) The decisions that will be taken will have an impact. Let's make sure they are positive for Europe. (ACEA 2023a)

Table 4: Salient Shift Responsibility Quotes

Exposure to air pollution can be viewed through this lens by placing blame on residents, rather than the corporations who profit from selling polluting products. For example, why can not a smoker go outside to smoke, or shouldn't cyclists just take another route to avoid exposure to street level pollutants? Industry actors are the most likely employ this argument, although some use also occurs in government sources.

Some of the shifting is nuanced, and within the context of environmental issues responsibility often falls on multiple stakeholders - manufacturers, regulatory bodies, and consumers alike. Therefore, the context, follow-up actions, and overall practices must then be taken into account to determine whether such a statement represents genuine commitment or an avoidance of accountability.

A constructive approach to shared responsibility must be therefore carefully employed. As such, statements from the European Automobile Manufacturers Association (French: Association des Constructeurs Européens d'Automobiles; abbreviated ACEA) such as:

> *"Improving air quality is an important objective for Europe. The quality and purity of air is vitally important to the health and wellbeing of the population, particularly in urban areas. All sectors need to contribute to help reduce the level of ambient air pollutants and road traffic will continue to make important contributions as part of an integrated and coordinated approach dealing with both air emissions and greenhouse gas emissions." (ACEA 2013)*

could represent a credible commitment towards improving urban air quality.

While there is a degree of subjectiveness in this assessment, the researcher believes that in the absence of market incentives to reduce pollutant emissions, a discerning reader must take into consideration the track record of the industry including such information as:

- When the International Council on Clean Transportation (ICCT) assessed the extent to which diesel cars in Europe, most sold by ACEA members, have been using defeat devices "suspicious" NOx emission levels were found in 77%–100% of tests, indicating the likely use of a prohibited defeat device (ICCT 2023).
    - The ACEA maintains that this is an "...issue affecting one individual company. There is no evidence that this is an industry-wide issue." (ACEA 2015b) and has not publicly spoken on the issue since 2015.
    - Instead, the AECA doubled down and launched a clean diesel campaign in 2016, including CarEmissionsTestingFacts.eu, a website that "provides a fact-based overview on everything related to the testing of car emissions in Europe." (ibid).
- Uncovered during the emissions cheating scandal in 2015, two years before the ACEA Air Quality statement was made in 2013, a Volkswagen engineer told a US court that work on emissions manipulation already began in 2006.
- The ACEA's position paper on Air Quality has not been updated for a decade (since 2013), despite a drastically heightened understanding of the health impacts of urban air pollution, and rapid shift in vehicle technology. Furthermore, Auto industry actors have been pointing to multi-stakeholder nature of air pollution for over fifty years now. Ford, a member of ACEA, launched "Your Car and Clean Air," in 1970 with the tagline, "Cleaner Air is Everyone's Responsibility." (Ford 1970)
- The AECA claims to comply with proposed Euro 7 requirements (EU legislation limiting air pollutants from vehicles), their members "*would be forced to move substantial engineering and financial resources from battery- and fuel-cell electric vehicles back to the internal combustion engine (ICE). It would not only put the brakes on our rapidly advancing electromobility roadmap but potentially set it into reverse gear. It is not good for the industry, not good for the climate, and certainly not good for people's health and well-being.*" (ACEA 2023a) Despite this statement, Europe's biggest automakers posted record profits in 2022 as net profits rose 22 percent to a record total of 67.8 billion EUR at the six largest Europe-based automakers: BMW Group, Mercedes-Benz, Renault Group, Stellantis, Volkswagen Group and Volvo Car plus the largest luxury automaker,

Ferrari (Automotive News Europe 2023). Suggesting that there are in fact, a record volume of financial resources available to the ACEA's members and the dichotomy presented of *either* reducing air pollution *or* abating climate change is disingenuous.

Including the above context into this statement, the researcher would argue that a simple statement about the wicked nature of poor urban air quality, made in 2013 – a decade from the publishing of this paper, does not satisfy the demand for transparency and accountability and rises to the level of 'shifting responsibility'.

While the City does less to espouse a shift responsibility storyline with respect to automobile pollution, the recommendation that "...citizens can advantageously reduce exposure to air pollution by choosing roads with less traffic and avoiding rush hour when moving around Copenhagen (City of Copenhagen 2021b)." can similarly be understood to shifting the burden of avoiding air pollution to citizens.

The arguments under this coding are much clearer when it comes to exposure to second-hand smoke. The industry position is that:

- Smokers must be 'accommodated' in indoor venues with smoking booths or rooms with specialized high ventilation equipment – shifting responsibility to these venues to clean the pollution caused by the industry's products
- The public must decide if they want to be in places where second-hand smoke takes place – shifting the responsibility to citizens to avoid pollution caused by the industry's products
- Smokers must decide "where and when they should smoke when they are together with other people. Smokers should not smoke near children and pregnant women." (ESTA 2023) again shifting the responsibility to citizens to avoid pollution caused by the industry's products.

The use of the phase "smokers" (and non-smokers) further reinforces that the responsibility of managing second-hand smoke lies with the person – not the product. This is a distinction rarely made with driving, where the car is listed as the source of pollution – not the driver.

The analysis has also uncovered the use of passive voice in several industry documents, for example, the phrase that "second-hand smoke *takes place"* suggests that this is a phenomenon that simply occurs, shifting the blame to no one. This storyline also occurs within the City's aims to achieve a smoke-free city "without pointing fingers", (City of Copenhagen 2022b). This claim is made as an acknowledgement to the difficulties of quitting smoking, primarily due to the addictive nature of nicotine (ADF 2022). However,

this does not recognize that tobacco companies genetically engineered their tobacco crops to contain two times the amount of nicotine (Leary 1994), and adjusted their cigarette design so that the nicotine delivered to smokers increased by 14.5% (Campaign for Tobacco-Free Kids 2014). By omitting this context, this storyline shifts the responsibility effectively to 'no-one' and the role of tobacco industry in creating addicted users and sources of second-hand smoke is diminished.

There is also debate as to whether the term environmental tobacco smoke raises the same issue of a responsibility shifting passive voice, as it was a term that was first invented by the tobacco industry in 1974 (Rylander 1974). It stands in contrast to the term second-hand smoke which places more focus on the exposed non-smoker and is overwhelmingly the most common used term in English speaking news media (Chapman 2003). However, given the common Danish description of other people's smoke is: passiv rygning [passive smoking] a term which is also common in many other languages (French: tabagisme passif, German: Passivrauchen, Italian: fumo passive, Russian: пассивное курение or passivnoye kureniye) the researcher sees no basis for this coding given then cultural and contextual nuances at play.

Given the deepness in which cars are interwoven into Danish (and global) society it is fair to state that urban air quality is a wicked problem, with many stakeholders and possible solutions. This coding raises the question, whose responsibility is clean air?

Returning to the original question aimed to uncover the existence of a motonormative society by Walker, Tapp, and Davis (2022), seen again below in Figure 8, second-hand smoke is viewed as an unacceptable form of air pollution, and to a large extent, traffic emissions are viewed as an acceptable form of air pollution.

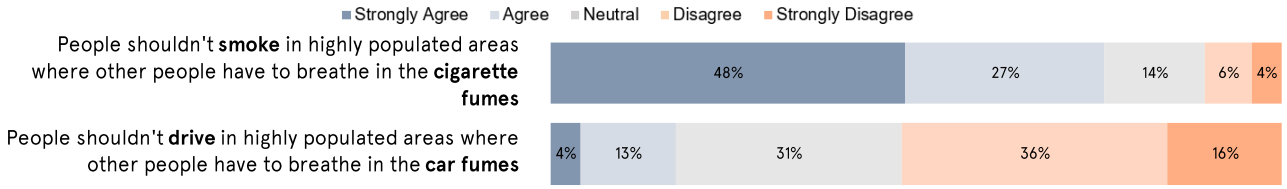

Figure 8: Are some forms of air pollution more acceptable than others? Adapted from Walker, Tapp, and Davis 2022.

From Walker, Tapp, and Davis's (2022) work, one can surmise that society views being exposed to second-hand smoke as a failure of induvial responsibility ("**People** should not smoke…". When including the context of storylines, this allocation of responsibility mirrors the industry storyline that smokers must carefully choose where to use their products. Whereas, being exposed to air pollution from automotive sources appears to be seen as a failure of collective responsibility, and thus not wholly attributable to any

one individual, corporation, or government. Therefore, it is rarely, if ever, suggested that drivers avoid hospitals, schools, or other areas with vulnerable populations.

The shift responsibility coding can also be seen in the storyline of 'personal choice', where the use of polluting products is presented a matter of personal choice or freedom, rather than public health. By emphasizing individual freedom and personal responsibility, actors can deflect corporate responsibility for addressing the pollution that their products cause. This storyline is widely used by both industries. The industry group Tobacco Europe ran an committee called "Freedom to Smoke" in the mid 1990's focusing on countering legislation on second-hand smoke, which as the name suggests, promoted the rights of smokers to smoke without restrictions (Tobacco Tactics 2020). Similarly, the auto industry has long connected private cars with "..independence and freedom of mobility." (ACEA 2022). This storyline has proved remarkably successful and is deeply embedded in contemporary global society (Walker, Tapp, and Davis 2022).

Therefore, both industries use this coding to shift responsibility for the pollution that their products cause to other actors. The tobacco industry largely shifts this responsibility to individuals who use their products, and to venues where smoking may occur. The auto industry shifts the responsibility to a complex set of actors, thereby highlighting the wicked nature of the problem. Meanwhile, the City's storylines suggest that citizens concerned with exposure to pollution consider avoiding rush hour traffic, and that no actor is responsible for second-hand smoke in the City.

6.1.2 Vulnerable Populations

As show in section 4.3.2: Vulnerable Populations, certain populations are more vulnerable to the harmful impacts of air pollution than others. A summary of salient quotes from this coding can be found in Table 5 below.

Actor	Tobacco	Automotive
Government – National	In child care centers, schools, boarding schools, continuation schools, institutions offering three-year secondary education, shelters, etc., which primarily admit children and adolescents under the age of 18, it is not permissible to smoke on the institution's premises. (Ministry of the Interior and Health 2012)	NA
Government – Municipal	Smoke-free playgrounds Initially, the municipality is taking action by making 125 municipal playgrounds smoke-	The fourth focus area is about exposure to health-damaging air pollution and targets

	free. This is done following international models with friendly signs advising people not to smoke. (City of Copenhagen 2012) [In relation to smoking-bans and no smoking 'suggestions'] We start where there are children. (City of Copenhagen 2012) Children and adults can move around without being bothered by tobacco smoke, where new generations do not start smoking, and where people who smoke can get help and support to become smoke-free. (City of Copenhagen 2022b)	particularly vulnerable groups of citizens. (City of Copenhagen 2021b) 35% of Copenhageners are children under 18, 17% of Copenhageners live with one or more chronic diseases, and 21% of Copenhageners are older than 65. Overall, in an air pollution context, these vulnerable groups represent a significant proportion of the citizens of Copenhagen." (City of Copenhagen 2021b) There are also citizens who are particularly vulnerable to the health consequences of air pollution, for whom the more acute physical and psychological discomforts can have a major impact on everyday life. Here lies a great potential for prevention in particularly vulnerable groups; children, pregnant women, citizens with chronically ill sentences and elderly citizens. (City of Copenhagen 2021b)
Industry	Smokers should not smoke near children and pregnant women. (PMI n.d.)	NA

Table 5: Salient Vulnerable Populations Quotes

Vulnerable populations may imply a small subset of the total population, however as noted in the City's annual report on air pollution 73% of Copenhageners can be considered to have an increased vulnerability to urban air pollution:

> *"35% of Copenhageners are children under 18, 17% of Copenhageners live with one or more chronic diseases, and 21% of Copenhageners are older than 65. Overall, in an air pollution context, these vulnerable groups represent a significant proportion of the citizens of Copenhagen."* (City of Copenhagen 2021b)

The analysis shows that some actors acknowledge a responsibility to protect these populations from poor air quality and employ this storyline to justify calls for increased regulation or protections on this basis. Within the analysis this storyline is employed by government sources as it relates to tobacco second-hand smoke exposure and to a limited extent urban air pollution from traffic.

Within the works analysed, industry actors largely avoid this coding, although the AECA does note that "Passenger car travel enables home care and medical assistance, as well as a range of other emergency services."(ACEA 2022). Resting on established industry narratives that cars give freedom *to* (vulnerable) populations and neglecting to mention that their products deny freedom *from* pollution. While PMI notes that "Smokers should not smoke near children and pregnant women." (PMI n.d.), which as discussed in the chapter above, is a statement aimed to shift responsibility of second-hand smoke exposure to those who consume PMI's products.

The messaging of protecting vulnerable populations is ubiquitous in smoking legislation from government sources (Ministry of the Interior and Health 2007; City of Copenhagen 2012) (emphasis added by author).

> *"... make Copenhagen an international pioneer city – a healthy, green metropolis, where **especially children** can move around without being exposed to smoke." (City of Copenhagen, 2012)*
>
> *"Rooms that are primarily designed as the rooms in which the **children play and are otherwise present will be required to be free of environmental tobacco smoke at all times."**(Ministry of the Interior and Health 2007)*
>
> *"Initially, we invite the places where there are many people and **especially children.**" (City of Copenhagen, 2012)*
>
> *"At child-care centres, primary and lower secondary schools, leisure centres and the like that mainly have enrolled children and adolescents younger than 16 years, children, **adolescents and students shall be prohibited from smoking on the property of the institution.**" (Ministry of the Interior and Health 2007)*
>
> *"That is why we must act now. We have to think about the smallest citizens of the city."* Mayor of Health and Care Services, Sisse Marie Welling (SF) (K. Brandt 2020)

With an especially strong focus on stopping the next generation from smoking, limiting and de-normalizing their exposure to second-hand smoke, and tobacco use.

Despite a clear focus on protecting vulnerable populations when it comes to legislation aimed at second-hand smoke, there is a comparative dearth of action tied to this argument when it comes to air pollution caused by traffic in Copenhagen. This stands in contrast to many peer cities such as London, Paris, Lima, and others which have all argued that children must be protected from automobile created pollution, and have taken

action to address this by closing streets or expanding strict low emission zones to encompass schools, playgrounds, or neonatal care units. (Mayor of London 2022; Marie de Paris 2023; C40 Cities 2022)

> *"The latest evidence shows that air pollution is making us sick from cradle to the grave. Londoners are developing life-changing illnesses, such as cancer, lung disease, dementia and asthma.* ***And it is especially dangerous for children*** *due to the long-lasting impact on their health and life chances, with kids in our city growing up with stunted lungs.* (Mayor of London 2022)

> *"'School streets' consist of the pedestrianization of roads around nursery and primary schools. They are intended to make the home-school path safer for children,* ***but also to fight against pollution.****"* (Marie de Paris 2023)

The City did provide a budget of 1.67 m DKK (~222k EUR) to study so-called `children's life zones' with a goal to... "partly to map children's life zones in Copenhagen, partly to come up with concrete proposals for how exposure to health-damaging air pollution can be reduced for children" (City of Copenhagen 2021a). The report provides six recommendations which are divided into strategic and physical measures. The physical measures are designed to address exposure to poor air quality by using physical barriers, moving key features away from roads and a "rethinking of the arrival situation [child drop off at education institutions]" whereas the strategic initiatives are focused on awareness campaigns, involvement with other stakeholders, and finally, reducing car traffic by limiting street parking through "strategic prioritization of children in traffic." (City of Copenhagen 2021a). The overall tone of the report, as noted by one of the authoring parties is to learn "...more about what cities can do to **minimize exposure** to air pollution" (COurban 2021). Addressing the source of the pollution is noted but remains a secondary objective.

Meeting minutes from the resort presentation to the Health and Care Committee dryly note that the city "gøre brug af viden og læring fra projektet, hvor det er relevant [will make use of knowledge and learning from the project, where relevant]" (City of Copenhagen 2021a) To date, significant implementation of the report's recommendations remain lacking. Given the large focus on Technical Solutionism through electromobility, it is possible that the city views this as a problem that will solve itself.

> *"The children who are in the city now will grow up before we are anywhere near having a fleet of cars that run on electricity in Denmark. That is why we must act now. We have to think about the smallest citizens of the city."*
> Mayor of Health and Care Services, Sisse Marie Welling (SF) (K. Brandt 2020)

While avoiding mentioning vulnerable populations directly, the ACEA has used images of children to re-enforce the purported low levels of emissions offered by 'clean diesel' as part of an industry campaign to "deliver clean and affordable transport for future generations." (ACEA 2015a) as seen in Figure 9 below.

Figure 9: Vulnerable populations in auto industry advertisements (ACEA 2015a)

Similar tactics have been used by tobacco manufactures, which in the past (before it was made illegal) often used children in smoking adverts with the aim to normalise smoking, and exposure to smoke, as part of family life (Clark 2016).

Figure 10: Vulnerable populations in tobacco industry advertisements (Clark 2016)

Several Danish municipalities including Copenhagen use children in smoke-free advertisements or "friendly-suggestions" to not smoke (which are not legally binding) as seen below in Figure 11 and Figure 12 (left). To the authors knowledge, no Danish municipalities use children visually to advocate for stronger pollution control from vehicles, as is shown in a mock-up in Figure 12 (right).

Figure 11: City of Copenhagen [thank you for not smoking where children and young people come] (City of Copenhagen 2021a)

Figure 12: Left; [A smoke-free future is at play here] (Røgfri Fremtid 2023), Right, Authors work, adapted from (Røgfri Fremtid 2023)

Overall, within vulnerable populations government sources primarily focus on children as advocates for a cleaner future, although there is mention of other groups. This storyline is also much more strongly correlated with pollution from tobacco sources than automotive sources. Elements of this stance are presented in a satirical comic strip below in Figure 13.

Figure 13: Is protecting vulnerable populations from one source of pollution more important than another? (Singer 2022)

6.1.3 Minimization

Minimization is the third most employed storyline found within the studied documents. The overall tone of this coding is subtle, often found in the specific rhetoric employed. Salient quotes presented have been gathered in Table 6 below.

Actor	Tobacco	Automotive
Government – National	NA	In Denmark, we have cleaner air than most other European countries, and air pollution has been decreasing for the past 30 years. The number of premature deaths related to air pollution in Denmark has almost halved from 1990 to today, and Denmark today complies with all EU limit values. (Energi-, Forsynings- og Klimaministerie 2018)
Government – Municipal	NA	The illustration emphasizes the importance of the public health perspective on air pollution, where there is a focus on the dose or amount of air pollution that one is exposed to when one moves around the city as a citizen. The greater the quantity, the greater the **potential** 'health damage'. (City of Copenhagen 2021b)
Industry	Environmental tobacco smoke is perceived as a nuisance and an irritant.(ESTA 2023) Provided non-smokers are not involuntary exposed to tobacco smoke, an adult's informed choice to smoke is not a matter for public health intervention in a free and open society. (ESTA 2023)	Exhaust pollutants from road transport are now a fraction of what they were two decades ago. ..resulting in an exhaust particle content that is comparable, sometimes even cleaner, than the ambient air. (ACEA 2013) Exhaust emissions are already at a barely measurable level thanks to state-of-the art vehicle technology. (ACEA 2023a) The implementation of advanced engine technology, advanced exhaust after-treatment systems and cleaner petrol and diesel fuel has helped slash pollutant emissions from cars, vans, trucks and buses, leading to huge improvements in overall air quality in urban areas. (ACEA 2023a) Recent studies, which take account of our industry's decarbonisation trajectories, have shown that Euro VII will only provide very marginal additional benefits to air quality (ACEA 2023a) In contrast to the very limited further reductions resulting from the introduction of a 'zero-exhaust' Euro 7/VII emission standard, early replacement (via an incentivized early scrappage scheme for example) would, on a vehicle for vehicle basis, result in some 6 to 25 times the emission reduction benefits for NOX and some 10 to 35 times the emissions reduction benefit for PM2.5. Importantly, these benefits would also be realized much earlier. (Aeris Europe 2021)

Table 6: Salient Quotes of Minimization

Within Denmark Forward – Infrastructure Plan 2035 the national government has minimized air pollution from automotive sources to the extent that it is not mentioned. This is despite that the report includes measures to address issues with tight interlinkages to urban air pollution, such as noise pollution, traffic congestion, road safety, greenhouse gas emissions from vehicles, and mode shift. Furthermore, that there is a clear role in for infrastructure to play in both minimizing the production of and exposure to automotive air pollution.

The overall tone of the City of Copenhagen's report on air quality does not minimize the harmful impacts of air pollution in the city, however there is still minimizing language found within the documents, such as this one quote which speaks to the *potential* health damage of air pollution.

> *Jo større mængde, jo større* ***potentiel*** *'sundhedsskade' [The greater the quantity, the greater the* ***potential*** *'health damage'] (City of Copenhagen 2021b - Emphasis Authors)*

As discussed above in the coding description of minimization, studies have found that there is no safe level of air pollution and as such all exposure to these pollutants *is* harmful, not *potentially* harmful (K. K. Lee et al. 2020; 2020; Orellano et al. 2020; Orellano, Reynoso, and Quaranta 2021; Chen and Hoek 2020; Huangfu and Atkinson 2020).

The automotive industry is strongly focused on presenting the improvements in reducing exhaust pollution have already made to minimize the pollution that their products emit today. They suggest that these improvements have resulted in "...huge improvements in overall air quality in urban areas." (ACEA 2013) thus utilizing a polluted past as the benchmark, and suggesting that the current state of pollution, and corresponding poor urban air quality, derived from their products is acceptable. This minimizes the negative health consequences of the pollution their products produced.

When looking at proposed Euro 7 standards the industry has commissioned an "independent study [undertaken on behalf of ACEA]" which has found that "...very limited further reductions resulting from the introduction of a 'zero-exhaust' Euro 7/VII emission standard." (Aeris Europe 2021). A report which is used to justify further minimizing statements such as "...[Euro 7] is not good for the industry, not good for the climate, and certainly not good for people's health and well-being." (ACEA 2023a). The study has been heavily criticized by the International Council on Clean Transportation (ICCT) on several points and considers it an inaccurate depiction of the benefits promised by Euro 7 (ICCT 2021).

Therefore, the industry has used science which has been carefully framed to legitimize claims that the potential improvements provided by new emissions reduction standards would be insignificant and stated that existing improvements have already led to vastly improved urban air quality, suggesting that the current state of urban air pollution causes only minor or insignificant impacts.

The analysis did not find any cases of minimization from government sources regarding air pollution from tobacco smoke. However, the analysis found minimizing claims from the tobacco industry. For example, "Environmental tobacco smoke is perceived as a nuisance and an irritant." (ESTA 2023) a statement which drastically minimizes the serious health impacts of second-hand smoke. Impacts which Phillip Morris have been required as a result of US court action to publicly note:

> *"Public health authorities, including the WHO, have concluded that second-hand smoke causes diseases, including lung cancer and heart disease, in non-smoking adults, as well as conditions in children such as asthma, respiratory infections, cough, wheezing, otitis media (middle ear infection), and sudden infant death syndrome. In addition, public health officials have concluded that second-hand smoke can exacerbate adult asthma and cause eye, throat, and nasal irritation." (PMI n.d.)*

The second major instance of minimization from the tobacco industry states:

> ***"Provided non-smokers are not involuntary exposed to tobacco smoke,*** *an adult's informed choice to smoke is not a matter for public health intervention in a free and open society."* (ESTA 2023) (emphasis added by author)

The key phrase being "Provided non-smokers are not involuntary exposed to tobacco smoke" (ibid) which assumes that such a state is possible. Especially in Copenhagen, where smoking on public streets, indoors at many hospitality establishments, at bus stops, and in front of buildings and air intakes remains legal, it is not possible to avoid each instance of exposure to second-hand smoke. In fact, studies have shown that approximately 31% of Danes are exposed to second-hand smoke annually (Tobacco Atlas 2022). This statement minimizes the reality that when consumed, these products pollute the air, and in the absence of total consumption bans in public spaces, some degree of involuntary exposure is inevitable.

These instances of minimization from the tobacco industry are relatively limited, which may reflect the new era of public relations pursed by the tobacco industry which has struggled to replenish credibility after decades of documented industry falsehoods.

Previous strategies of the tobacco industry were more directly involved with discrediting the science of second-hand smoke, and otherwise minimising the perceived harm of exposure. Their efforts follow familiar steps for any actor whishing to avoid accountability, **deny** (minimize to great extent), **discredit** (minimize and start to shift responsibility), and finally **diffuse** (shift responsibility, covered in the chapter above and the current industry playbook).

Starting with denial, Philip Morris in 1987, released a series of advertisements that pictured smokers speaking "Please don't tell me my cigarette smoke is harmful to you. There's just no convincing proof that it is." and "I know there's no proof my smoke can hurt you." (Truth Initiative 2017) Following this denial of the problem, internal development at Phillip Morris showed a willingness to move to the next phase, discredit:

> *"Whether or not we succeed in discrediting the notion that ETS is a health risk, we can place the risk in context and thereby minimize it. Thus, non-smokers may still believe ETS is a health risk, but on a par with driving a car, or shoveling snow."* (PMI: Unsigned Memo 1989)

Which was then followed by a six week campaign in Europe where Phillip Morris argued that second-hand smoke exposure was less harmful than milk, thus minimizing the problem (AP 1996)

> *"... passive smoke is less likely to cause lung cancer than drinking 1-2 glasses of whole milk each day. They [Phillip Morris] also say eating one cookie a day is more likely to cause heart disease than passive smoke is likely to cause lung cancer. `There is a constant drumbeat on the issue that my smoke is hurting you," he said. `That is the principle we are working on, because it is not backed by the evidence." David Greenberg, a Philip Morris spokesman in Europe"* (AP 1996)

Today, the tobacco industry is a post-minimization phase and thus dominant tactic within minimization of the impacts of second-hand smoke is to not mention it. Due to the robust nature of scientific literature covering the harms of second-hand smoke, and an established culture of recognising these harms, the industry has no credible way to minimize the health harms of second-hand smoke and must thus instead focus on how to shift responsibility onto other actors.

In summary, when speaking to automotive sources of urban air pollution the National government speaks to having better-than-average air quality at a national level and mentions that Denmark complies with EU legislation but does not mention that they do not comply with WHO guidelines for clear air. The City, while not employing minimization

as a key storyline, uses minimizing language at times in their analysis of air quality in Copenhagen. Finally, the auto industry focuses on improvements from a time where air pollution caused more deaths than today, thus minimizing those that still occur, and has used industry-backed science to discredit potential air quality benefits under Euro 7. The tobacco industry speaks to second-hand smoke as a "nuisance", undermining cancerous and other harmful impacts, and proposes an improbable (or more likely, impossible) reality where their polluting products do not impact those who choose not to consume them. The latter statement minimizes the fact that exposure to second-hand smoke is likely an inevitable consequence of using smoking tobacco.

6.1.4 Socioeconomic Threat

In the analysis, socioeconomic threats were most often used by the industry, but often reflected in at the national government level. Salient quotes from this coding are listed below in Table 7.

Actor	Tobacco	Automotive
Government – National	It may be decided that smoking is permitted indoors at small hospitality establishments (pubs) that: 1) have a licence to serve alcohol; 2) do not serve food; 3) have floor space not exceeding 40 m2; and 4) have tables and chairs on the floor space. (Ministry of the Interior and Health 2007)	We must continue to be able to drive and do business in our largest cities. (Energi-, Forsynings- og Klimaministerie 2018)
Government – Municipal	"The Alternative initially advocates that it is those who do not smoke who should be taken into account first, but believes that this proposal [to ban smoking in public outdoor areas in the City of Copenhagen] goes too far in terms of restricting personal freedom." (City of Copenhagen 2020) "The [Smoke-free Copenhagen 2025] strategy focuses on preventing smoking initiation among children and young people, ensuring smoke-free areas in the city and offering smoking cessation to all Copenhageners who want to quit cigarettes. The strategy is	-

	based on a set of values where the key word is voluntariness rather than finger-wagging." (City of Copenhagen 2020)	
Industry	Respect and consideration for non-smokers is vital, and people must always be aware of how their lifestyle choices impact those around them. Equally, smokers should not be ostracised for electing to smoke. **The most appropriate policy response is to enforce measures that provide smoke-free environments for non-smokers whilst accommodating smokers through designated, ventilated smoking areas.** Pragmatism rather than dogmatism should be the guiding principle that sees adult choices respected." (ESTA 2023)	If petrol and diesel cars are banned from driving in the cities, it will have major consequences for both citizens and businesses (DI 2022) Job-related mobility is of particular importance, with about a half of all vehicle kilometres travelled in the EU being related to employment. (ACEA 2022) It can be very expensive for the companies that have to attract employees to the cities if only electric cars can drive to the company. They will also be hit by the same additional costs for vans, which will serve companies in the new zones (DI 2022) Euro VII comes at a time when major markets like the US are establishing a policy framework which aims to accelerate the transition to fossil-free alternatives by creating an attractive investment environment. The Inflation Reduction Act (IRA) in the US creates massive incentives to focus on battery-electric and hydrogen powered vehicles. (ACEA 2023a) [Underneath Article arguing Euro 7 will negatively impact the industry] About the EU automobile industry 13.0 million Europeans work in the automotive sector 11.5% of all manufacturing jobs in the EU €374.6 billion in tax revenue for European governments €79.5 billion trade surplus for the European Union Almost 8% of EU GDP generated by the auto industry €58.8 billion in R&D spending annually, 32% of EU total (AECA 2022)

		The Euro 7 proposal is a complicated and costly reform. It will lead to higher prices for consumers and operators, who risk holding on to their older, more polluting vehicles for longer. (ACEA 2023b)

Table 7: Salient Socioeconomic Threats

Through special exceptions in the smoke-free environments act, and relying on Occam's razor (The simplest explanation is usually the best one) it is assertained that the hopsitatility industry has sucessfully lobbied that enforcing smoke-free enviroments in all casses would lead to undue economic harm via reduced patronage. In Denmark, a small hospitality establishments (pubs) may allow smoking indoors if they:

1) have a licence to serve alcohol;
2) do not serve food;
3) have floor space not exceeding 40 m^2; and
4) have tables and chairs on the floor space (Ministry of the Interior and Health 2007)

Larger establishements must provide separate smoking booths or rooms. The essense of the arugment being that if patrons cannot smoke in an establishment then they will likely choose not to go out which would driving a disastorious economic return for the hospitatility industry.

However, this arugment does not largely stem from the hospitailty industry (Dearlove 2002). The tobacco industry, led by Philip Morris, works very hard to promote a storyline of 'accommodation' whereby smokers and non-smokers must 'learn to get along' (Dearlove 2002). This argument is clearly mirrored in the European Smoking Tobacco Association's position on the matter:

> *"Respect and consideration for non-smokers is vital, and people must always be aware of how their lifestyle choices impact those around them. Equally, smokers should not be ostracised for electing to smoke. The most appropriate policy response is to enforce measures that provide smoke-free environments for non-smokers whilst accommodating smokers through designated, ventilated smoking areas. Pragmatism rather than dogmatism should be the guiding principle that sees adult choices respected."* (ESTA 2023)

The storyline of 'accommodation' was then pushed onto the hospitability industry which became an effective proxy for the tobacco industry in arguing against smoke-free environments. This storyline also suggests that it is the role of the hospitality industry to clean the resulting pollution of the tobacco industries products by embracing expensive

ventilation equipment, thereby also serving to again shift this role away from the tobacco industry (shift responsibility). Despite this messaging, 100% smoke-free laws, which have no provisions to allow indoor smoking, have been shown to have no effect on business revenues, or improve them (Dearlove 2002).

While this resarch did not uncover a compairable instance of the auto industry directly funding a proxy industry, the overarching messsage from automobile manufuactors is that only cars can provide the mobility needed to participlate in economic activities.

> *"Without individual mobility,* ***adequate participation in social and economic life would not be possible in many cases,*** *particularly for people living in remote areas, the elderly and those with disabilities."* (ACEA 2022) (Emphasis added by author)

This is mirrored by, Dansk Industri which is in their own words "Denmark's largest, most representative and most influential business and employers' organisation" (Dansk Industri n.d.) states:

> *If petrol and diesel cars are banned from driving in the cities, it will have major consequences for both citizens and businesses (DI 2022)*

Local busniess assoiations have also used similar arguments when presented with rise of tools to address urban air quaility (low emission zones, pedestriation, etc.) As an example, a trial period of a pedistrian and bycicle resdesign of a popular retail street in Copenhagen, Nørrebrogade, was met with firece resistance by the Nørrebro Retailers Association and some politicians on the basis that it will harm the economic activity of the area.

> *"First up, the traffic study has cost between 300 and 500 jobs on Nørrebrogade because almost all shops have declined in sales since the trial started. In addition, I have spoken with many residents who feel insecure about the fact that the area has become* ***virtually a village with no life.****' Johnny Beyer, deputy chairman of the Nørrebro Retailers Association. Beyer stressed that the decline in trade on the street was not only due to the recession. According to the union's own research,* ***the decline in trade in Nørrebro had been two to three times higher than in the country's retail industry as a whole.*** *Lars Dueholm, the Liberal Party's member of the engineering and environment committee, agreed.* ***He said Nørrebrogade merchants were unhappy because they had lost customers with the dying traffic on the street.*** *'Cyclists may be happy to have more space but do we*

> *really want Nørrebrogade turning into a cycling highway?' Dueholm said."* ("Car-free Nørrebrogade could be permanent" 2009)

While it remains important to give carful consideration on how traffic calmed areas are implemented, and some studies have shown a slight reduction in turnover during a transition period, it has long been shown that traffic calmed areas see higher levels of retail shopping as that people simply prefer a pedestrian-friendly environment to a vehicle-oriented one (Hass-Klau 1993; Yoshimura et al. 2022; Yim Yiu 2011; Tobon, Jaramillo, and Sarmiento 2018).

This messaging can be reflected in statements by the Danish government, which directly tie the car to economic activies:

> *"We must continue to be able to drive and do business in our largest cities." (Energi-, Forsynings- og Klimaministerie 2018)*

However, this storyline is not reflected in the municipal doucments studied. Broadening the anaylsis under this coding has also revealed friction between the two levels of government. This is exemplified when the City began exploring options to control air pollution via a low emissions zone (LEZ):

> *"In 2003, the municipality of Copenhagen applied for permission to implement a low emission zone requiring particulate filters for heavy vehicles (> 3.5 tons). After a two-year waiting period the Ministry of Justice denied the application. The key denial argument was that low emission zones were expropriation of business vehicle owners' right to pollute." (The Danish Ecological Council 2014)*

Although the city was eventually successful in implementing a LEZ by 2008, five years later, there is clearly still different approaches to speaking about, and addressing, air pollution at the national and municipal levels in Denmark. The current extent of the LEZ is pictured below in Figure 13.

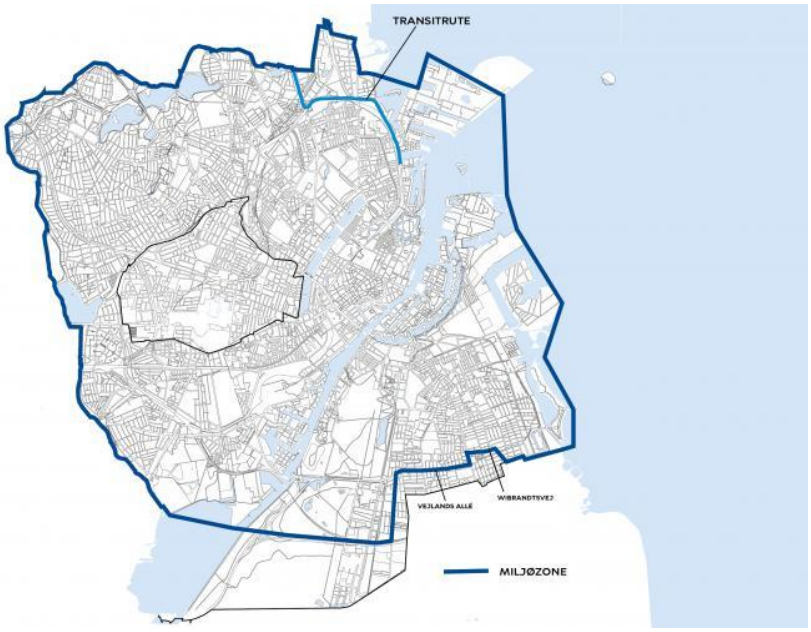

Figure 14: Low Emissions Zone in Copenhagen (City of Copenhagen 2022a)

There additionally remains so called "Transit Routes" in the north of the city which allow for unrestricted access for industry purposes.

However, the City has agured the oppposite to protect citizens right to pollute with tobacco products outdoors. For context, second-hand smoke harms those exposed in both indoor and outdoor settings. The difference between the two settings is that second-hand smoke in outdoor settings dissapiates faster, but the smoke contains the same carcigens and particulate matter. In a study that looked at participants exposure to second-hand smoke outside bars, elevated biomarkers assoiated with smoking, and it is harmful effects, were noted postexposure (St et al. 2012).

Dispite this, smoking outdoors in most public spaces including parks, bus stops, streets, air intakes and playgrounds remains legal. In 2020, a member proposal to ban smoking in public outdoor areas in the City of Copenhagen was unmanioumsly voted down and parties noted (emphasis added by author):

> *The Alternative made the following protocol remark, which the Conservative People's Party and the Liberal Alliance chose to endorse: "The Alternative initially advocates that it is those who do not smoke who should be taken into account first, but believes that this proposal goes* ***too far in terms of restricting personal freedom.****" (City of Copenhagen 2020)*
>
> *The Unity List, the Alternative, the Radical Liberals and the Liberals made the following protocol remark, which chose to endorse: "...The [Smoke-free Copenhagen 2025] strategy focuses on preventing smoking initiation among*

children and young people, ensuring smoke-free areas in the city and offering smoking cessation to all Copenhageners who want to quit cigarettes. ***The strategy is based on a set of values where the key word is voluntariness rather than finger-wagging...*** *Therefore, the parties propose to refer the member's proposal to the committee for consideration in the context of the planned thematic discussion." (City of Copenhagen 2020)*

Here the various parties representing the city have choosen to link smoking to personal freedoms, and insist that the measures used to lessen harms of smoking do not coerce behaviour that would reduce the use of these pollting products.

As a middle ground approach, the city has endorsed signage which presents "friendly suggetsions" that park visitors not smoke in the presence of children and young people, see Figure 11 in Vunerable Poplations above. These signs are not legally binding and no offical smoking ban is in place.

The AECA automotive industry group also consistently reinfornces the economic activity of the automotive industry, usually adding a subnote to position papers and opinion pieces, one such example as shown below in Figure 15. Suggesting that any measures that restrict this industry will result in economic downturn.

Figure 15: Veiled Socioeconomic Threats, the Auto Industry

Overall, the storylines for air pollution from cars from industry and the national government here is clear: the car is nessasary for a prosporus economy.

In summary, the automotive industry has often used the language of business and commerce to frame discussions around access reductions (pedistrisation, low emission zones,etc.) , arguing that limiting car access to certain areas would harm local businesses and the economy. They have also aruged that addressing urban air pollution through these

access restrictions may exacerbate mobilty inequality while ignoring rampant pollution inequality whereby typically disenfrancised and minorty groups are the most likely to be exposed to poor urban air quality. To a large extent, the national government appears to agree with the automtive and tobaccoo industry, while the City of Copenhagen largely avoids connecting cars and socio-economic issues. When commenting on pending EU pollutant legislation, the automotive industry often stresses the potential for protective legislation to harm the competitiveness of the industry on the international stage (ACEA 2023a) and highlights the high economic impact of the sector.

Meanwhile, the tobacco industry has utilized a proxy found in the hospitatility industry to advance their interests in contentious public policy debates. Aruging against indoor smoking bans, claiming that such bans would unfairly harm bars and restaurants that cater to smokers (Dearlove 2002). Therefore dispite some restrictions on indoor smoking, the industry has sucessfully lobbied the national government to allow for the provision of smoking booths or rooms in larger establishements and fully allow smoking in establishements less than 40m2, which,"... as it turns out, Copenhagen has plenty of these little places." (Routes North 2016). The City has also aruged that smoking bans outdoors would be an unacceptable govermental overreach by restricting personal freedoms, and that reducing second-hand smoke exposure should only be done on a voluntary basis.

In both cases, industry and some government actors have sought to frame the debate in terms of economic impact and individual rights, and minimize or do not acknoweldge the broader public health and environmental concerns at stake.

These economic impacts and individual rights are narrlowly framed, not including for example the externatilies of poor air quality which is paid for by public heath authories in Denmark to the tune of 4 billion DKK (~537M EUR) annually in Copenhagen alone, or the indivudal rights of those who do not wish to be exposed to toxic air. Industry therefore largely focuses on portraying freedom as a licence to pollute for those who wish to. In other words, freedom *to* pollute rather than, freedom *from* pollution. This concept represented in the satirical comic below in Figure 16.

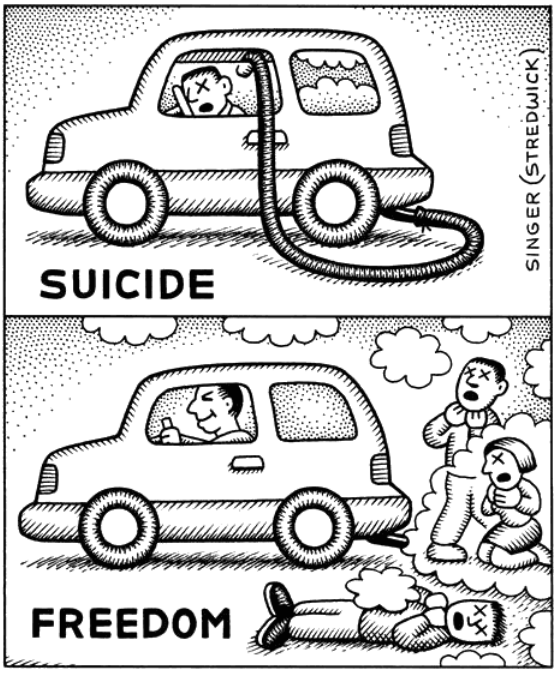

Figure 16: Freedom to or Freedom From? (Singer 2022)

6.1.5 Tech Solutionism

Commonly presented as an argument by the industry, there are also echoes of this argument in Government sources. Tech solutionism offers an appealing solution to the air pollution presented by both industries, as it does not require systematic changes to existing business models and gives licence to the industry to claim to be working toward the public's best interest, all while serving a `natural' need or market – making this argument closely linked to the [Industry] Saviour coding. Some of the strongest quotes from this coding are presented below in Table 8.

Actor	Tobacco	Automotive
Government – National		We must be a society where, for many, the car will still be the key to getting everyday life together, especially outside the big cities - but where the car in the future must be green. (Transportministeriet 2021) On the way to that goal, we will create a Denmark without petrol and diesel cars, with clean air in the cities (Energi-, Forsynings- og Klimaministerie 2018) We are completely dependent on technology development going faster (Energi-, Forsynings- og Klimaministerie 2018)

Government – Municipal		In addition, in Copenhagen in 2022 we have adopted new action plans for car-sharing, electric charging infrastructure and much more. (City of Copenhagen 2021b) The children who are in the city now will grow up before we are anywhere near having a fleet of cars that run on electricity in Denmark. That is why we must act now. We have to think about the smallest citizens of the city. Mayor of Health and Care Services, Sisse Marie Welling (SF) (K. Brandt 2020)
Industry	At PMI, it is our ambition to replace cigarettes with science-based smoke-free products as soon as possible. These products provide nicotine without burning, making them a much better alternative to cigarettes. These products, which are addictive and not risk-free, are only for those adults who would otherwise continue to smoke. (PMI 2023) The answers for the future lie squarely in a fierce commitment to science and technological innovation. … Over the past decade, we have had an enormous scientific and technological breakthrough: Companies such as mine have developed smoke-free products that eliminate combustion—products such as e-cigarettes and heated tobacco systems. (PMI 2021)	Road transport has made huge progress in recent years and continues to make significant advances. The implementation of advanced engine technology, advanced exhaust after-treatment systems and cleaner petrol and diesel fuel has helped slash pollutant emissions from cars, vans, trucks and buses, leading to huge improvements in overall air quality in urban areas. (ACEA 2013) Engine efficiency improvements and exhaust after-treatment systems have brought about massive reductions in carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), particulate matter (PM) and ultrafine particles (PN) from cars, vans and heavy commercial vehicles. (ACEA 2013)

Table 8: Salient Tech Solutionism Quotes

The tobacco industry is investing significant capital and effort into expanding upon the sales of smokeless products. These products, such as vaporisers (vapes), heated tobacco products (HTP's), or oral products including Snus do not rely on combustion to deliver pharmaceutical agents. Therefore, reducing second-hand smoke exposure. There are four major transnational tobacco companies; Philip Morris International (PMI), British American Tobacco (BAT), Japan Tobacco International (JTI), and Imperial Brands [Formerly: Imperial Tobacco] who controlled approximately 69% of the global market (excluding China) in 2008. They have rallied around these products as the future of the tobacco industry (S. Lee, Ling, and Glantz 2012). This strategy is prominently featured on

each of these companies websites, as seen below in Figure 17, and in the following quotes (PMI 2023; BAT n.d.; JTI n.d.; Imperial Brand 2022).

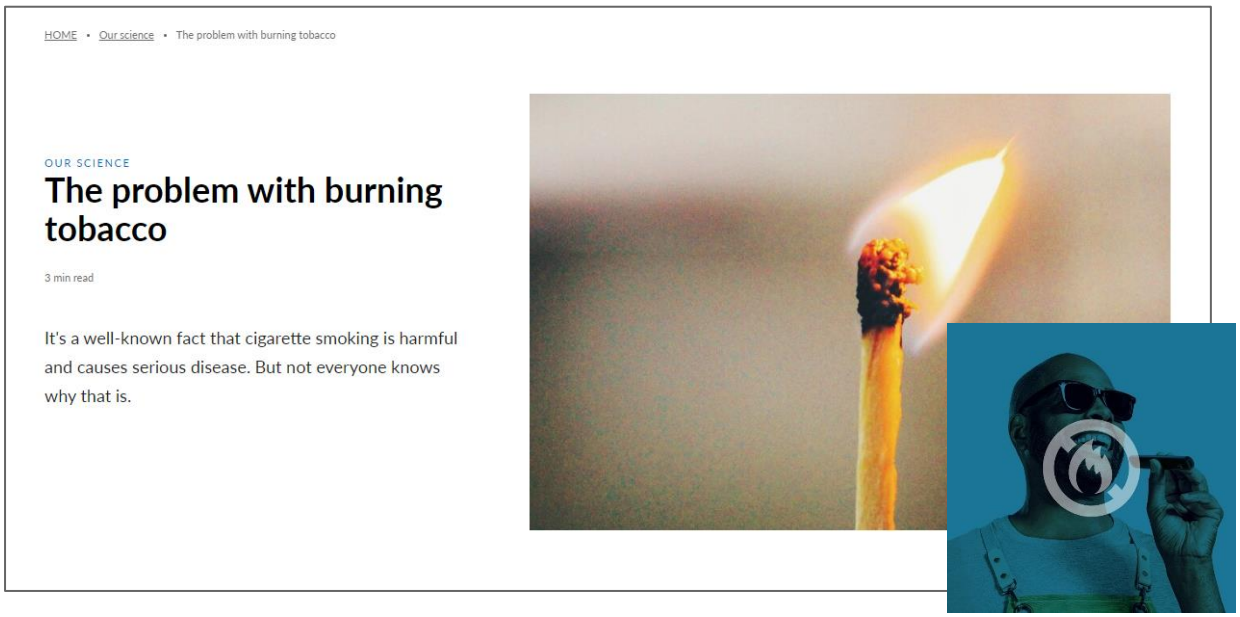

Figure 17: The problem with combustion. Top: (PMI 2023), Bottom Right: (Imperial Brand 2022)

> ***"The answers for the future lie squarely in a fierce commitment to science and technological innovation. ...*** *Over the past decade, we have had an enormous scientific and technological breakthrough: Companies such as mine have developed* ***smoke-free products that eliminate combustion****—products such as e-cigarettes and heated tobacco systems."*
> *Jacek Olczak, PMI Chief Executive* (PMI 2021)
>
> *At PMI, it is our ambition to replace cigarettes with science-based smoke-free products as soon as possible. These products provide nicotine without burning, making them a much better alternative to cigarettes. (PMI 2023)*
>
> *"We will build A Better Tomorrow™ through a multi-category portfolio of non-combustible products, tailored to meet the preferences of adult consumers... Our focus on scientifically-substantiated, reduced-risk*† tobacco and nicotine products continues... " (BAT n.d.)*
>
> *Reduced-Risk Products play a key role in building a sustainable future. Through our leading global RRP brands, we develop, test and bring to market new and innovative forms of potentially reduced-risk products, such as heated tobacco products, e-cigarettes and nicotine pouches. RRP[s] are core to the sustainability of our business. (JTI n.d.)*

> *We understand society's concerns about the health risks of smoking and recognize our role in helping to reduce the harm caused by* ***combustible*** *tobacco products. Our ambition is to make a meaningful contribution to tobacco harm reduction. Clearly, the best health-related outcome is for adult smokers to stop smoking. However, the next best option is to offer potentially harm reduced alternative products to those consumers who are uninterested or unwilling to stop smoking. (Imperial Brand 2022)*

At present government sources do not recognize the difference between delivery mechanisms (combustion or non-combustion products) and work to support the prevention of "...smoking and other use of tobacco and nicotine containing products" indiscriminately (Danish Health Authority 2018). As such, government sources do not endorse non-combustion tobacco and nicotine containing products as a solution to the exposure of second-hand smoke.

The automobile industry has similarly rallied around electric vehicles (EV's), which do not rely on combustion, as the necessary and natural evolution of mobility.

De Danske Bilimportører, the trade association for car manufacturers' representation in Denmark, directly corresponds the increasing sale of electric, and plug-in hybrid cars to progress on the 'green transition', see Figure 18 below, and goes further to say "Elbiler er fremtiden for den grønne transport, det må der ikke herske tvivl om. [Electric cars are the future of green transport, let there be no doubt about that.]" (De Danske Bilimportører 2023)

Figure 18: Conflating electric cars and the mobility transition (De Danske Bilimportører 2023)

Within the automobile industry, this approach is directly supported by the national government which has endorsed several methods to increase the number of EV's in urban areas, such as allowing "...low- and zero-emission cars to drive in bus lanes." (Energi-, Forsynings- og Klimaministerie 2018). A move which directly contradicts established methods of moving towards sustainable urban mobility (SUM) whereby the private car ownership should be deeply discouraged wherever possible (Holden et al. 2020).

As defined by Holden et al. 2020, there are three 'Grand Narratives' employed within the SUM transition, "Low-mobility societies, Collective transport 2.0, and Electromobility" (Holden et al. 2020). Electromobility is defined as:

> *"The preferred Grand Narrative for people who rely on greener, sustainable, more efficient, improved, or simply 'better' technology to achieve sustainable mobility (the improve strategy). Thus, technological optimists definitely feel comfortable in this narrative because* ***it does not challenge the way we travel or demand us to travel less."*** *(Holden et al. 2020)*

These narratives are largely listed in order of importance of chronological implementation, but should be "..told and unfold simultaneously." (Holden et al. 2020). Moving in the reverse ranked order, these narratives could easily complement or substitute each other negatively. Thus, a over emphasis on electromobility to achieve SUM, could be ineffective or at worst, actively impede progress on required systemic changes. However, this is the preferred approach of the Danish national government to address urban air quality, who emphasise the need for rapid development of EV technology to address air quality and climate change: (Emphasis added by author)

> *Vi er helt afængige af, at teknologiudviklingen går hurtigere [****We are completely dependent on technology development going faster.****] (Energi-, Forsynings- og Klimaministerie 2018)*

> *We must be a society where, for many,* ***the car will still be the key to getting everyday life together,*** *especially outside the big cities -* ***but where the car in the future must be green.*** *(Transportministeriet 2021)*

To a lesser extent, the City similarly relies on EV's to drive significant reductions in urban air pollution:

> *"The children who are in the city now will grow up before we are anywhere near having a fleet of cars that run on electricity in Denmark. That is why we must act now. We have to think about the smallest citizens of the city."*
> Mayor of Health and Care Services, Sisse Marie Welling (SF) (K. Brandt 2020)

While EV's conclusively emit less greenhouse gasses over their lifetime, there are still emerging concerns over their impacts on non-exhaust emissions such as brake and tire wear, which account for 90% of PM_{10} and 85% of $PM_{2.5}$ emissions from traffic (Timmers and Achten 2016; Pero, Delogu, and Pierini 2018; Temporelli, Carvalho, and Girardi 2020). As tire and break wear & emissions are proportional to the friction between the tire and the road, and the momentum of the vehicle respectively, both of which increase proportionally with vehicle weight there are concerns that as EV's weigh more than ICE vehicles a focus on tailpipe emissions may be missing important sources of PM.

Switching from ICE's to EV's additionally does not address other aspects of car dependency which hamper implementation to other solutions to urban air quality, such as increasing the mode share of collective transport or active mobility or reducing transport demand through urban design concepts such as the 15-minute city. Some of the problems presented by car dependency are illustrated below in Figure 19.

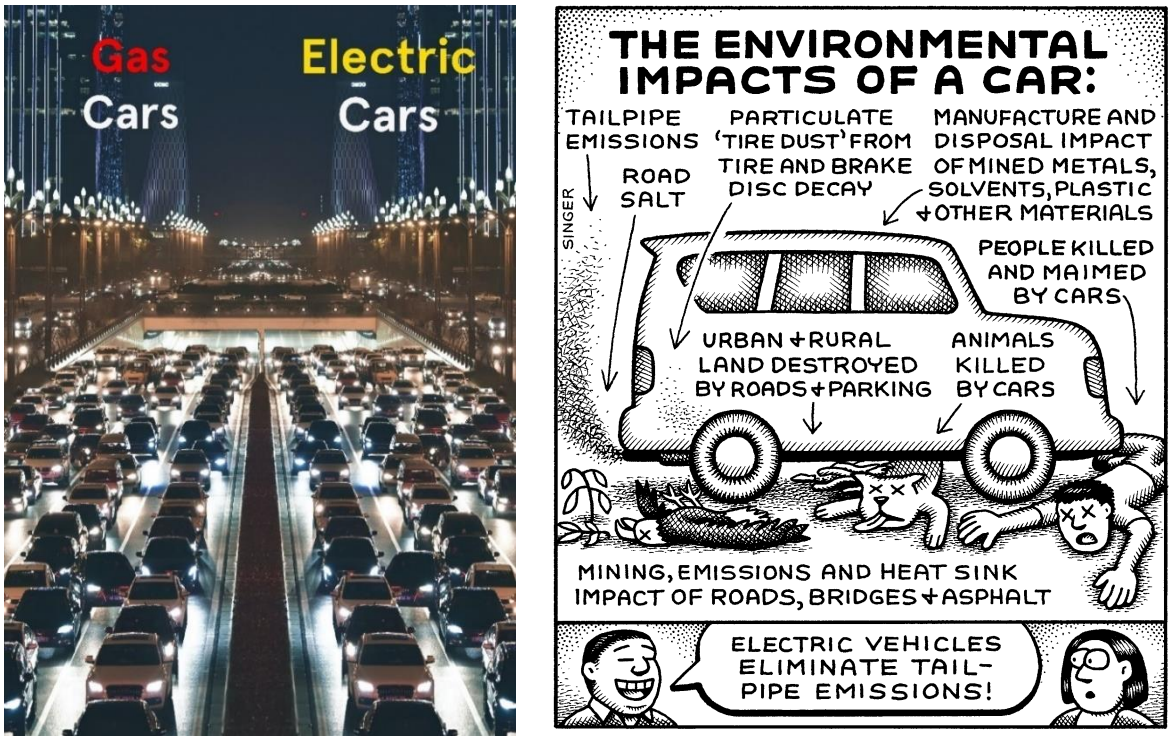

Figure 19: Impacts of Cars. Left, Authors Own Figure. Right Image, Courtsey of Andy Singer (Singer 2022)

Therefore, both industries endorse a switch to non-combustion products. To address air pollution from automotive sources this approach is strongly supported by the government, however, it is not recognized as a strategy to reduce exposure to air pollution from tobacco sources.

6.1.6 [Industry] Saviour

To varying degrees, the [Industry] saviour narrative is used by both government and industry sources from both the tobacco and automotive sources of poor air quality. The [Industry] saviour storyline positions products as the only way to meet a demand, and thus argues that 'the ends justify the means' to distance themselves from the negative consequences of these products. Relevant quotes from this framing are highlighted below in Table 9.

Actor	Tobacco	Automotive
Government – National	NA	Vi skal fortsat kunne køre og drive forretning i vores største byer [We must continue to be able to drive and do business in our largest cities.] (Transportministeriet 2021) We must be a society where, for many, the car will still be the key to getting everyday life together, especially outside the big cities - but where the car in the future must be green. This is the vision on which we base our plans for future transport. This is the future the government wants for Denmark. (Transportministeriet 2021)
Government – Municipal	NA	NA
Industry	In March 2017, DR launched comprehensive coverage of the problem of contraband cigarettes in Denmark. The case formed the basis for a 21 Sunday broadcast, several features in DR News and a number of articles on dr.dk Tobacco producers are working to highlight the problem of contraband cigarettes and to secure government support for efforts against the illegal market.	The proposal will therefore affect all citizens who do not have an electric car, even if the government plans to exempt residents in environmental zones. "Depending on how many municipalities create a zero-emission zone, it will affect the everyday life of a number of ordinary citizens, who can no longer use their recently purchased petrol or diesel car when they have to drive to work" says Karsten Lauritzen, branch director of DI Transport (DI 2022) For over a hundred years, the private car has transformed modern society by providing independence and freedom of mobility. Cars are our number one source of mobility, taking the average European almost 12,000 kilometres a year. ("Fact Sheet: Cars" 2022)

		Mobility is becoming more and more important due to ever-increasing distances between home, work, educational institutions, shopping and leisure facilities. ("Fact Sheet: Cars" 2022) Almost 80% of inland journeys are made by car – be it private car, taxi or carsharing. **Without individual mobility, adequate participation in social and economic life would not be possible in many cases**, particularly for people living in remote areas, the elderly and those with disabilities. People living in urban areas may rely on taxis, carsharing or on-demand services instead of, or as a complement to, their own private car. (ACEA 2022)

Table 9: Salient [Industry] Saviour Quotes

Within the automotive industry, this is often seen in the correlation of automobiles as *the* solution for mobility, without allowing the consideration of other modes. Therefore, the negative effects that the car pushes on society must be accepted just to meet an ever-increasing demand for mobility. Questions such as, do cars best meet existing mobility demand, or are we approaching, or already in, a state of hypermobility, are ignored in this framing. In some cases, the logic presented by the auto industry becomes circular, pointing to a need for more mobility provided by cars due to the increasing distance of amenities due to the increase of space required to build infrastructure for cars.

> *Mobility is becoming more and more important due to ever-increasing distances between home, work, educational institutions, shopping and leisure facilities.* (ACEA 2022)

Other statements simply more directly link cars as the most important provider of mobility:

> *For over a hundred years, the private car has transformed modern society by providing independence and freedom of mobility.* ***Cars are our number one source of mobility,*** *taking the average European almost 12,000 kilometres a year.* (ACEA 2022)

The national government similarly creates a connection between the economy, life, and automobile mobility.

> *Vi skal fortsat kunne køre og drive forretning i vores største byer [We must continue to be able to drive and do business in our largest cities.]* (Transportministeriet 2021)
>
> *We must be a society where, for many, the car will still be the key to getting everyday life together, especially outside the big cities - but where the car in the future must be green. This is the vision on which we base our plans for future transport. This is the future the government wants for Denmark.* (Transportministeriet 2021)

The municipality was not found to use the [Industry] Saviour storyline.

Within the tobacco industry there are similar arguments used. The coding shows an outsized focus on controlling illicit Tobacco. This discussion allows tobacco companies to argue that they are simply meeting demand of tobacco consumers, because if too many restrictions are placed on cigarettes, or where you can smoke them, users will simply smoke elsewhere or purchase tobacco from illicit sources. This argument disassociates the role of tobacco companies in creating consumers addicted to products which routinely harm users and nearby non-users. Similar industries, such as the alcohol industry, do not mention this coding on industry group websites, despite facing higher rates of illicit products (~21% of alcohol consumed in the EU is illicit, compared to 10% of tobacco products) (Manning and Kowalska 2021; Tobaksproducenterne 2023).

In 2012, when additional restrictions were placed on smoking in the workplace in Denmark the [industry] savior argument was mirrored by a member of the Danish Parliament (Folketinget) to suggest that tobacco smoking bans will *increase* exposure to second-hand smoke, espeically to minors, as office workers may instead choose to smoke at home or on the street.

> *"I actually think that the new smoking law will mean more people will become exposed to tobacco smoke as everyone files outside to smoke by the entrances to buildings," Henrik Thulesen Dahl from DF said. "They become more visible and so may also inspire more people to smoke." (The Copenhagen Post 2012)*

What this argument fails to note however, is evidence from several studies that show that workplace smoking bans reduce cigarette consumption even in habitual smokers by 3.1 cigarettes a day, and greatly benefit non-smokers by limiting exposure to second-hand smoke (CDC 2022; Catalano and Gilleskie 2021).

Automotive and tobacco industry actors use this storyline to define the consumption or use of their products as inherent. Polluting cars are thus framed as the only solution to meet an inflexible, and ever increasing, demand for mobility, restrictive policies against purchasing cigarettes are seen as encouraging the proliferation of the black market, and workplace smoking bans will increase exposure to second-hand smoke because there is an incompressible demand for these products.

*6.1.7 The Scientific Evidence**

The tobacco industry wrote the playbook on corporate denial and avoidance of responsibility for the public health crisis which their product causes. At first, this was done with outright lies or grossly exaggerated claims, as shown in Figure 20 below, but now has transformed into strategic framing of complex issues and avoidance of others.

Figure 20: Unfounded Health Claims (Herlufsen 2022)

The analysis shows that industry groups from the automotive and tobacco industry are well versed in carefully framing of the issue of pollution caused by their products implicitly realizing that framing of the debate will invariably narrow outcomes, producing

different arguments which invoke different evidence, and engage the public and governments a distinct manner. Select quotes from this coding are included below in Table 10.

Actor	Tobacco	Automotive
Government – National	NA	NA
Government – Municipal	NA	NA
Industry	The regulation of smoking should, like all public policy, be reasonable, proportionate and evidence based.(ESTA 2023) Tobacco regulation, like all public policies, should be based on sound science. Sound science relies on facts and evidence — not on subjective, unsubstantiated opinions. For tobacco regulation to be credible, it must draw on science conducted through, transparent research of high academic standards. This is vital to ensuring that tobacco control measures are reasonable and proportionate. There is a wealth of evidence on the health risks of tobacco and the impact of tobacco control measures. It is this evidence, not the opinions of those participating in the debate, that should guide policymakers in further regulating tobacco products. (ESTA 2023)	An independent study undertaken on behalf of ACEA (Aeris Europe 2021) The most advanced trucks now emit 86% less NOx and 95% less particulate matter than those trucks from the early 1990s. Over the past 10 years, truck exhaust emissions have reduced by 35% despite an increase in 'work done' (measured in tonne-km) by 30% (ACEA 2013) Modern road vehicles with diesel engines use highly efficient particle filters that remove well over 99% of all particles formed in the combustion process (by number or mass), resulting in an exhaust particle content that is comparable, sometimes even cleaner, than the ambient air. (ACEA 2013)

Table 10: Salient The Scientific Evidence Quotes*

The Scientific Evidence* storyline, invokes an appeal to science as the basis for legitimizing an activity. Usually this is done with a calculated narrow or aim or scope, with a particular aim or goal. This storyline has broad overlaps with scientification, a term defined by Weingart as "a process whereby the use of and claim to systematic and certified knowledge produced in the spirit of 'truth-seeking' science becomes the chief legitimating source for activity in virtually all other functional subsystems" (Weingart, 1997: 610).

However, careful consideration by the reader should be given to the use of "claim to systematic and certified knowledge produced in the spirit of 'truth-seeking'", especially within an industry where incumbent actors have a proven track record of intentional deceit, for example the widespread diesel emissions scandal, or decades of misinformation campaigns orchestrated by the tobacco industry (Smorodin 2023; Smith et al. 2011).

The origin or some of this coding can be traced back to what McCright terms the "Anti-Reflexivity Thesis" which is presented as a direct rejection of the tenants of Reflexive Modernization theory (McCright 2016). Reflexive modernization theory argues that within an advanced industrial society, institutions which gave rise to rapid modernisation suffer from a legitimacy crisis due to their failure to address the ecological and technological problems of modernisation and therefore an increased focus on reflexivity is a prerequisite for solving these crises.

This in turn has given rise to a counter movement of 'anti-reflexivity' by those who have something to gain by defending the legitimacy of the industrial capitalist system against the radical changes proposed by reflexive modernization. Anti-reflexivity opposes the forces of reflexivity, especially those who urge government action to deal with problems caused by an industrial capitalist system. Reflexive and anti-reflexive perspectives both utilize science in distinct ways to advance their viewpoints. Generally, the perspectives utilize impact science and production science respectively.

Production science is defined as scientific activities in service to economic production (e.g., mining, industrial, consumerist, technological) (Orr 1980), whereas impact science aims to measure the impacts of science and technology (and natural events) in an attempt to force societal recognition of, and action on, major ecological and technological crises (McCright 2016). Actors who prioritize the current economic system favor production science over impact science, as it supports an anti-reflexivity narrative, avoiding the need for expansive economic reform.

The Scientific Evidence* highlights the use of production science in storylines, which is often supported by specific rhetoric such as "common sense", "sound-science", "facts", an overarching 'hard' science methodology and an avoidance of social or 'soft' (impact) sciences. An overemphasis on production science alone avoids the "spirit of 'truth-seeking'" and this is where The Scientific Evidence* coding differs from the more wholistic term of scientification.

Industry actors often prefer production science, which they characterize as "sound science", or simply "facts", and impact science is described in terms of "junk science",

or "subjective, unsubstantiated opinions". This is effectively summarized by McGarity (2003), as "Our Science is Sound Science and Their Science is Junk Science" (McGarity 2003). This rhetoric is abundant in industry sources:

> *"Tobacco regulation, like all public policies, should be based on* ***sound science. Sound science relies on facts and evidence — not on subjective, unsubstantiated opinions.*** *For tobacco regulation to be credible, it must draw on* ***science*** *conducted through,* ***transparent research of high academic standards."*** (ESTA 2023)
>
> *"The member companies have an interest in ensuring that the legislation is implemented on as* ***informed a basis*** *as possible, so that tobacco and nicotine legislation in Denmark does not become subject to* ***symbolic*** *legislation."* (Tobaks Producenterne n.d.)
>
> *"If road freight transport is to maintain its role in serving society it must decarbonise quickly. To achieve this, we must be* ***fast, smart and decisive, applying sound and fact-based decision making.*** *... Zero-emission vehicles will not only bring down CO2 emissions, they will also improve air quality levels fast – a factor of crucial significance for human health."* (ACEA 2020)
>
> ***"Our Science.*** *Since 2008, here at Philip Morris International, we've invested more than USD 10.5 billion into the* ***science and research of developing smoke-free products.*** *... When it comes to science and research, we set ourselves the highest standards, and our scientific methods are inspired by the pharmaceutical industry. We share our scientific findings publicly and encourage others to review our work."* (PMI 2023)
>
> ***"Science deserves a seat at the table.*** *Speaking at the 2021 Concordia Annual Summit, PMI Chief Executive Jacek Olczak pleaded for public health policies to be based on transparent peer-reviewed science, rather than the ideological opinions of special interest groups that shut out critics and silence debate."* (PMI 2021)

This coding can also be reinforced visually, as seen below in Figure 21.

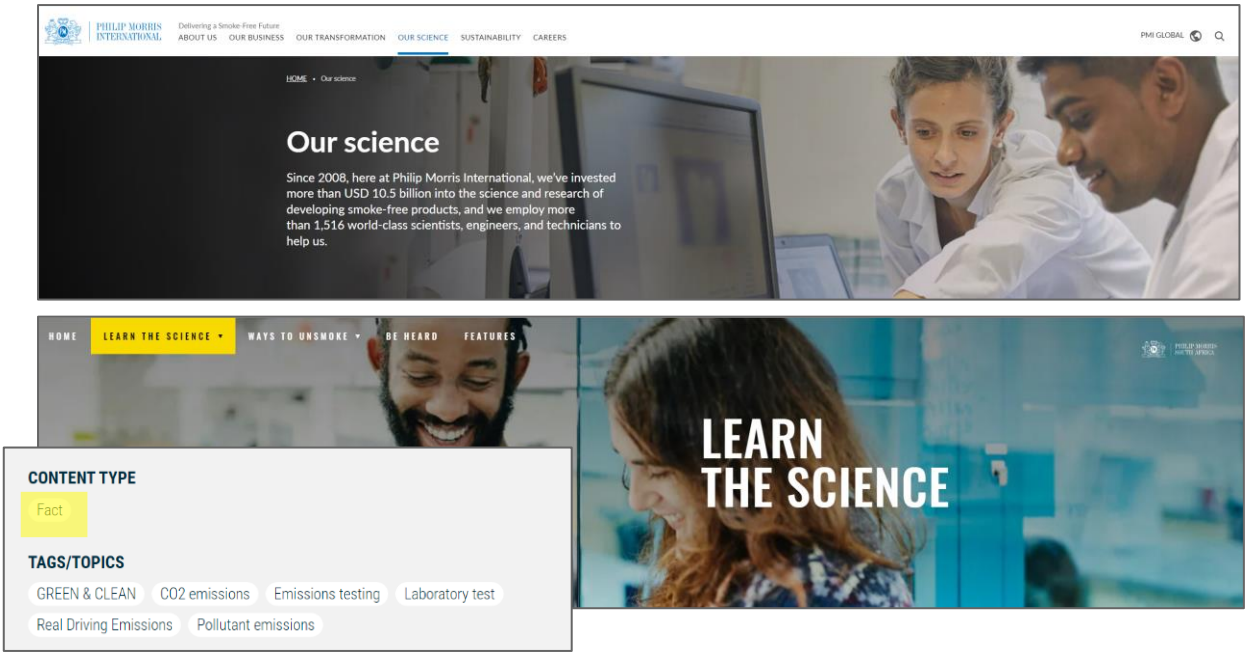

Figure 21: The Scientific Evidence as presented by PMI and the ACEA (PMI 2023)*

The visual representation of this coding can also be seen in a video endorsed by Tobaks Producenterne [Tobacco Manufacturers] where two people, dressed in white lab coats, expose cotton balls to smoke from cigarettes and vaping respectively, as seen in Figure 22. The video concludes by showing that the cotton balls exposed to vape smoke have less tar and residue on them when compared to cigarette smoking (Tobaks Producenterne n.d.). This sort of production science avoids speaking to wider impacts of these products and oversimplifies complex issues.

Figure 22: Production Science can be used to legitimize positions (Tobaks Producenterne n.d.).

The basis for the tobacco industry argument is that these "reduced-risk", non-combustible products support the science of harm reduction for both users and those exposed to second-hand smoke. The industry claims that these products will support harm reduction by offering alternatives to whose who cannot or do not wish to stop using tobacco or nicotine products. However, this argument neglects that these products also entice *new* users and thus any sincere science-based argument for harm reduction includes discussion of harm reduction at a population level – not only at an individual level (Osibogun, Bursac, and Maziak 2020; Soneji et al. 2018). For example, in Denmark, the number of both E-cigarette users and smokers has increased from 3% to 5% and 18% to 19% from 2020 to 2022 respectively (Sundhedsstyrelsen 2023b). Thus, this storyline relies on a narrow framing production science (creating combustion free products), and eschew questions brought about by impact science (do these products support population-level harm reduction?). By only looking at particular elements of science, the industry is trying to co-opt this coding, so they may forcibly include themselves into movements that have purposefully excluded them. To put it simply, these companies have a fiduciary responsibility to maximize sales and combustion-less products are one of the only remaining ways to retain access to existing markets or expand into others. Summarized in other words, "Ultimately, the tobacco industry is in the business of addiction" (Jo Cranwell as cited in Wheaton 2019).

This tactic is also employed by the auto industry which utilizes a narrow framing of production science to support their argument that they have already radically improved the pollution from their products. Further implying that air pollution is a complex multi-stakeholder issue which now must be addressed by other actors "Improving air quality is an important objective for **Europe**" (Shifting blame, emphasis added by author). The auto industry argues:

> *"Modern road vehicles with diesel engines use highly efficient particle filters that remove well over 99% of all particles formed in the combustion process (by number or mass), resulting in an exhaust particle content that is comparable, sometimes even cleaner, than the ambient air."* (ACEA 2013)

Production science has produced the technology that traps the particles formed during combustion. However, this quote has been carefully framed to avoid speaking to the larger impacts, which would be provided by an impact science perspective. It is already known that over 90% of particulate emissions are caused by non-exhaust emissions, a fact recognized by the same auto industry group, so by neglecting to mention the wider context the reader is led to believe that the auto industry has already achieved

remarkable breakthroughs in addressing urban air pollution (Timmers and Achten 2016). A point that is repeated throughout the studied material:

> *"Over the past 10 years, truck exhaust emissions have reduced by 35% despite an increase in 'work done' (measured in tonne-km) by 30%".* (ACEA 2013)

Furthermore, these statements only refer to PM which is only one pollutant, and neglects NOx emissions. Looking at the historical context, these arguments are like those made by Ford, a member of ACEA, in 1970:

> *Vehicle emissions are declining as a significant source of air pollution. Soon after automobiles were identified as a contributor to the air pollution problem, auto makers began intensive research and development efforts to eliminate offending emissions. ... Leaders of each of the American auto-producing companies have publicly declared their dedication to achieving virtually pollution-free engines.*
>
> *As 1971 cars emerge from assembly plants across the country, hydrocarbon emissions from the average new vehicle will have been lowered by about 80 percent and carbon monoxide by more than 65 percent compared with 1962 models.* (Ford 1970)

Here, over 50 years ago, a future with "virtually pollution-free engines" is promised, and the recent efforts to reduce this pollution are highlighted (Ford 1970).

Production science can also be employed with a flagrant disregard to the wider view of the impacts, something which the auto industry has used with disastrous consequences. This is noted by the Danish government, which uses an entire step as part of its 38-point plan to address air quality and climate change as "There must be an end to NOx cheating." Pointing to the Volkswagen emissions scandal also known as "Diesel-gate", whereby Volkswagen was caught systematically employing defeat devices in their products which masked exhaust emissions to comply with US and EU regulations (Leggett 2017).

Although the auto-industry has stressed that this is an "...issue affecting one individual company." and "There is no evidence that this is an industry-wide issue." (ACEA 2015b) impact science employed by the ICCT shows that the real world emissions of diesel cars from several European manufactures to far exceed emissions regulations. (Smorodin 2023). In fact, 77%-100% of the vehicle models tested showing "extreme" emissions, indicating that a defeat device is almost certainly present, seen below in Figure 23.

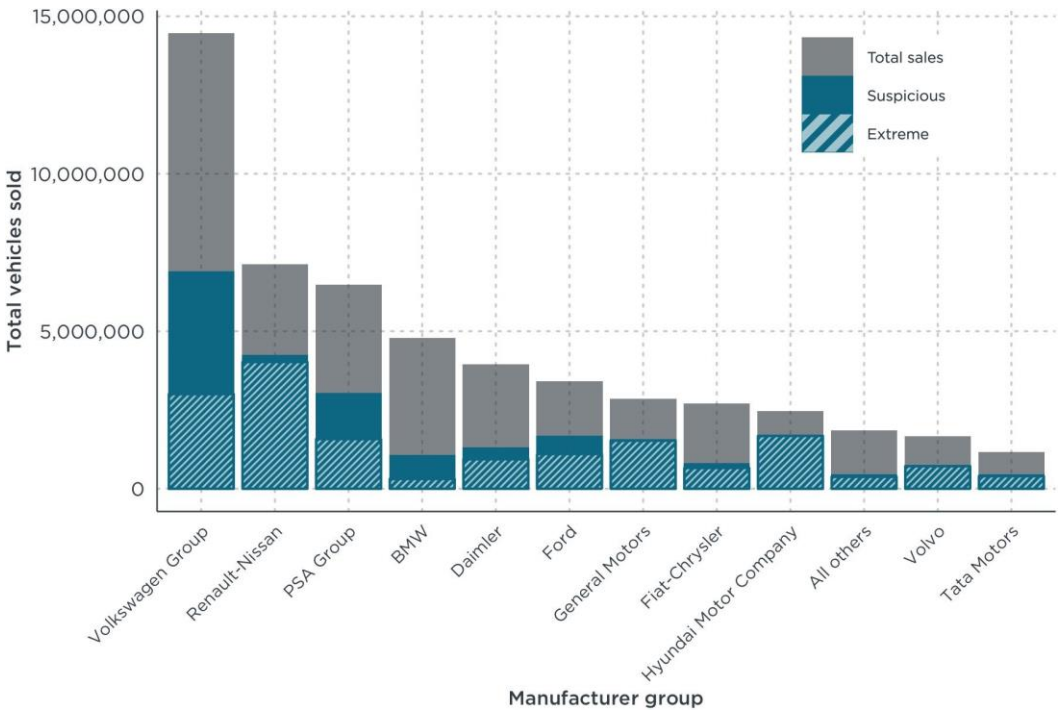

Figure 23: Extreme Emissions Are Industry-Wide (Smorodin 2023)

Overall, the analysis shows that industry is yielding 'science' and more specially an anti-reflexive production science to support their arguments. The tobacco industry argues that that their scientific breakthroughs in creating non-combustion products which support a scientific approach of harm reduction are being rejected by interest groups who are "prioritizing ideology, politics, and a desire for retribution over progress." (PMI 2021) and who refuse "to accept the science behind these alternatives and rejecting harm reduction as a solution for better." (ibid).

Meanwhile, the auto industry presents its own narrative in 'Fact sheets' that proposed pollutant standards, Euro 7, "...is unlikely to make much more of an impact and may even be counterproductive" (AECA 2022) instead choosing to highlight the reduction in PM exhaust emissions that have been achieved. Simultaneously ignoring that science has also been yielded to circumnavigate emissions standards. EV's are also spoken as the key solution to urban air pollution, without regard for non-exhaust emissions.

Government sources did not use this coding the studied literature.

6.2 Summarization of Actor Storylines

The storylines presented by each actor, under each coding identified, are summarized in the below Table 11.

These storylines were formed by the researcher as condensed versions of the arguments presented by each actor under each coding. Where relevant, they are sometimes direct quotes from the studied material. The strength of the storyline has been ranked through the researcher's qualitative reflection of the analysis. The rankings are defined as follows:

- Storyline forms a key part of argumentation
- Storyline is presented as a part of argumentation
- Storyline is presented as a part of argumentation, but is minor or secondary to others

Coding	Actor	Tobacco Sources of Air Pollution	Automotive Sources of Air Pollution
Minimization	Nat. Gov.	NA	Denmark's air is cleaner than Europe's average and we are a global leader in clean air.
	Mun. Gov.	NA	NA
	Industry	Environmental tobacco smoke is perceived as a nuisance and an irritant.	Road transport exhaust emissions are a fraction of what they were two decades ago.
Socioeconomic Threat	Nat. Gov.	To protect the hospitality sector, indoor smoking may be accommodated under specified conditions.	We must continue to be able to drive and do business in our largest cities.
	Mun. Gov.	Banning outdoor smoking in the City would go too far in terms of restricting personal freedom.	NA
	Industry	Smokers must be accommodated through designated, ventilated smoking areas. Banning smoking in the hospitality industry would be an undue economic burden.	Petrol and diesel vehicles in cities are critical to citizens and businesses. Euro 7 will negatively impact the EU auto industry, which is a critical economic force, and increase costs for consumers.
Tech Solutionism	Nat. Gov.	Rates of smoking must be lowered alongside the use of tobacco or nicotine products	Cars are vital but to balance life's demands with sustainability, they must turn green (electric).
	Mun. Gov.	NA	Protecting the City's smallest citizens by advancing EV charging infrastructure & promoting EVs.
	Industry	Replace cigarettes with science-based smoke-free products that eliminate combustion.	Road transport has transformed, with advanced engines, exhaust systems, and cleaner fuels drastically cutting pollutants from vehicles, elevating urban air quality. Increased EV sales represent progress on the 'green transition'.
Shift Responsibility	Nat. Gov.	NA	NA
	Mun. Gov.	A smoke-free capital by 2025 on a voluntary basis and without pointing fingers.	Healthier choices for cleaner air – citizens should choose less trafficked roads and avoid rush hours.
	Industry	Smokers must be accommodated through designated, ventilated smoking areas (by the hospitality industry). Smokers should not smoke near children and pregnant women.	All sectors need to contribute to help reduce the level of air pollutants. Exhaust emissions are at an all-time low.

Coding	Actor	Tobacco	Automotive
[Industry Savior]	Nat. Gov.	NA	Cars are vital. To balance life's demands with sustainability, they must turn green.
	Mun. Gov.	NA	NA
	Industry	The tobacco industry will only go underground if harshly restricted, a democratic society must respect the freedom to smoke.	Cars are a societal linchpin, providing independence and freedom of mobility.
The Scientific Evidence*	Nat. Gov.	NA	NA
	Mun. Gov.	NA	NA
	Industry	Tobacco regulation must be based on sound science, relying on facts and evidence — not on subjective, unsubstantiated opinions.	The industry has already vastly improved exhaust emissions on our way to virtually pollution-free engines. We must apply sound and fact-based decision making to decarbonize and improve air quality.
Vulnerable Populations	Nat. Gov.	Smoking bans on child focused institutions protect our children	NA
	Mun. Gov.	A healthy, green metropolis, where especially children can move around without being exposed to smoke	Minimizing exposure to health-damaging air pollution, especially for Copenhagen's vulnerable groups—children, pregnant women the chronically ill, and seniors—is vital.
	Industry	Smokers should not smoke near children and pregnant women.	Clean diesel – safe enough for children!

Table 11: Summary of Dominant Storylines

Storyline forms a key part of argumentation
Storyline is presented as a part of argumentation
Storyline is presented as a part of argumentation, but is minor or secondary to others

These storylines are further summarized by actor in Table 12.

Actor	Tobacco	Automotive
National Government	Exposure to passive smoking and smoking is strongly discouraged for the next generation. To protect the hospitality sector, indoor smoking may be accommodated under specified conditions.	Denmark's air is cleaner most of Europe's and we are a global leader in clean air already. Cars remain indispensable to life and the economy, and we will address urban air pollution and climate change through a rapid transition to electric mobility.
Municipal Government	A healthy, green metropolis, where especially children can move around without being exposed to smoke - on a voluntary basis and without pointing fingers or through undo restriction of personal freedoms.	Minimizing exposure to health-damaging air pollution, especially for Copenhagen's vulnerable groups—children, pregnant women the chronically ill, and seniors—is vital. EV's will effectively address urban air pollution but not fast enough.
Industry	Tobacco regulation must be based on sound science, relying on facts and evidence — not on subjective, unsubstantiated opinions. Smokers must be accommodated with smoking areas and booths indoors. We will work to replace cigarettes with science-based smoke-free reduced-risk* products that eliminate combustion.	Cars are a societal linchpin, providing independence and freedom of mobility. All sectors need to contribute to help reduce the level of ambient air pollutants, the auto industry has already achieved remarkable success in reducing road transport emissions. Expanding LEZ's will harm the economy and proposed Euro 7 legislation will minimally improve, or even worsen, air quality, slow the EV transition, cost consumers more, reduce international competitiveness, and risk slowing fleet renewal – which is the best solution for urban air pollution.

Table 12: Summary of Actor Storylines

Several of these storylines work together to produce a particular world view, and others coming from different backgrounds often use the same line of argumentation. These interactions will be discussed further in the chapter below.

7 Discussion: Storyline Interaction

This section will discuss how the storylines presented by diverse actors interact, using terms inspired in the theory provided by Hajer (2006).

7.1 Storyline Coalition and Affinity

The analysis has shown several instances of storyline coalition and affinity identified using the following definitions inspired by Hajer (2006).

> **Storyline Affinity:** arguments that have very different roots and meanings but together uphold a particular way of seeing (M. Hajer 2006)
>
> **Storyline Coalition:** ensemble of particular storylines, the actors that employ them, and the practices through which the discourse involved extern their power (M. Hajer 2006).

These definitions are further explained in section 3.2 Storyline Interaction above.

7.1.1 Storyline Affinity

The analysis has also revealed storyline affinity between the [Industry] Saviour storyline and a techo-solutionist storylines whereby as the use of polluting products in inevitable, the only solution is to reduce the pollution through technological improvements. To address pollution from the automotive industry this is seen through the continued storyline and focus on using electric vehicles or improvements to internal combustion engines as the preferred method to address air pollution, and similarly, the tobacco industry's focus on 'harm reduction' through less 'risky', or in reality – harmful, products such as HTP's, oral products, and e-cigarettes as a bad-faith argument to retain existing business models & expand their customer base.

There is also affinity between the tobacco industry's argument that smokers must be accommodated through specialized high ventilation smoking rooms and booths and the aim of the City of Copenhagen's report on minimizing *exposure* to air pollution in "children life-zones". The root of both arguments being that these polluting products, whether they be tobacco products or cars, must be accommodated. Therefore, solutions identified are centered around measures to reduce exposure to pollution. This can be seen in recommendations to move children's playgrounds away from busy streets, the installation of infrastructure or vegetation as to barrier to air pollution, or the creation of smoking rooms and booths. Reducing pollution receives comparatively less focus in this affinty.

The analysis has also shown a clear preference in the City of Copenhagen's storylines towards a positive communication style. This is seen in both the promotion of the Smoke-free Copenhagen 2025, and the storylines that vulnerable populations must be protected from exposure to air pollution. Another storyline relevant for this affinity, not noted in the codings, but discussed in Section 3.1: Story Telling and Storylines, is the City's storyline of the "The Best Cycling City in the World".

Although these storylines have different approaches and aims, they all offer positive solutions to lessen the use of polluting products, either through city-funded smoking cessation to those who want it or by offering a biking as a pollution-free mobility alternative. All storylines avoid placing accusatory blame on the users of polluting products. These approaches follow the motivational approach of the 'carrot' by aiming to make less polluting behavior easier and avoid employing to the 'stick' motivational approach whereby pollution behaviour itself is made more difficult. These storylines are summarized in Table 13 below.

Pollution Source	Tobacco and Nicotine Containing Products	Cars
Storyline	A smoke-free capital by 2025 - on a voluntary basis and without pointing fingers. (City of Copenhagen 2022b)	The fourth focus area is about exposure to health-damaging air pollution and targets particularly vulnerable groups of citizens. (City of Copenhagen 2021b) "Copenhagen - The Best Cycling City in the World" (City of Copenhagen 2023b). Fortunately, we are already underway. The bicycle is a central part of the solution, and we are working to make it the obvious choice of transport.(City of Copenhagen 2021b)
Targeted Action	Aided and voluntary, smoking or tobacco /nicotine product use cessation	Mode shift from cars to biking, avoid *exposure* to air pollution from cars

Table 13: City of Copenhagen prefers the carrot over the stick to enable less polluting practices.

7.1.2 Storyline Coalition

The auto industry employes a powerful storyline coalition to argue that addressing air pollution through the Euro 7 standard would be detrimental. In this coalition, the auto industry has combined several storylines to justifies its stance against Euro 7. Summarizing their arguments, the ACEA has:

commissioned a report which uses an appeal to (narrowly framed) science by omitting key considerations (e.g., it does not consider petrol cars) to,	The Scientific Evidence*
conclude the impact that Euro 7 will be minimal,	Minimization
and states that a higher uptake of fleet renewal using the latest technology would be a more effective way to reduce pollution.	Tech-Solutionism
The auto industry adds that Euro 7 this will lead to increased costs for consumers and operators, which will	Socioeconomic Threat
further hurt industry competitiveness on the global stage.	Socioeconomic Threat

The underlying message is clear, the industry would rather consumers purchase cars from their existing portfolios to address air quality rather than invest in making the next generation of vehicles less polluting. The main problem that the industry has identified is the lack of uptake of cleaner technologies, a problem that can be fixed by furthering the industry's number one goal – maximizing profit.

Within the socioeconomic threat coding, it was found that the tabacco industry directly sponsored the hospitatility industry to advance it is storyline that indoor smoking bans would undely harm the ecomic returns of the hospitatility industry. The resarch did not uncover a compairable instance of the auto industry directly funding a proxy industry. However, it is clear that the storylines presented by both the industry, and other actors such as the Nørrebro Retailers Association both lean on the same storylines, as seen in Table 14.

Nørrebro Retailers Association	ACEA
According to the union's own research, ***the decline in trade in Nørrebro had been two to three times higher than in the country's retail industry as a whole.*** *Lars Dueholm, the Liberal Party's member of the engineering and environment committee, agreed.* ***He said Nørrebrogade merchants were unhappy because they had lost customers with the dying traffic on the street.*** ("Car-free Nørrebrogade could be permanent" 2009)	*"Without individual mobility [provided by cars],* ***adequate participation in social and economic life would not be possible in many cases..."*** (ACEA 2022)

Table 14: The car is required for a prosperous economy – industry and group storylines

This is where storyline coalition does most of the heavy lifting. Even though the actors may not have the same interests, they are both contributing to a common outcome. Demonstrating an empirical example for the underlining theory – that actors do not necessarily have to work in coordinated ways or share profound values and influence bias.

As the one of the leading causes of air pollution in the city, it is interesting that the City of Copenhagen does not utilize storylines which speak directly to cars. Instead, the city

focuses on reducing exposure to car generated pollution, promoting the use of pollution free mobility, measuring air pollution, and addressing air pollution through the installation of a LEZ in 2008. In this storyline coalition, titled by the researcher as 'The invisible car', the City speaks to, and measures, air pollution from cars but avoids using storylines that directly mention cars. This will be discussed further below in relation to the found dominant storylines.

7.2 Dominant Storylines

These storylines are said to be dominant if they exhibit a high degree of structurization and institutionalisation. These terms are defined below, inspired by Hajer (2006).

> **Storyline Structurization**: When a storyline starts to dominant the way a given social unit (a policy domain, a firm, a society, etc.) conceptualises the world (M. Hajer 2006).
>
> **Storyline Institutionalisation**: The solidification of structurization within institutional arrangements (M. Hajer 2006).

To measure the influence of any particual storyline, the extent to which diverse actors use it to concuptulise the world (Structurization), and to what degree is solidifies into institutions and organisation practices (Institutionalisation) is then measured. If a storyline has strong elements of both concepts, it is considered dominant. Dominant storylines are identified using this methodology below.

DS1 Cars are a necessity for life and the economy.

The auto industry has successfully connected automobility and mobility and thus the concept of 'freedom'. This inevitability of cars is seen reflected in all actors' storylines and is thus structuralized and institutionalized. Due to this dominant storyline, actors are either unable to, or unwilling to, address the pollution inherit in cars. The national government follows industry storylines closely with the exception of having a heightened focus on EV's, rather than improvements to the ICE, to provide combined air quality and climate benefits. This dominant storyline clearly impacts the storylines employed by the municipality of Copenhagen. As found in the storyline coalition above, 'The invisible car', the city's storylines are focused on avoiding exposure to air pollution, measuring air pollution, addressing air pollution via a LEZ, and speaking to the benefits of cycling. By avoiding directly speaking about cars, these actions and storylines are structured in such a way that they can sidestep debates for-or-against a motonormative society. Avoiding speaking against this dominant storyline limits options for the City but may result in less contentious storylines which are more likely to appeal to a diverse range of stakeholders.

DS2 **Some polluting products must be `accommodated' in urban life.**

Although in the past the tobacco industry has successfully linked individual freedoms and smoking, this connection has been eroded. Smoking bans in place in Denmark severely restrict where smoking can take place with the aim to limit exposure to second-hand smoke. However, these bans are seen as a balance between protecting citizens from exposure to second-hand smoke, allowing economic prosperity for the hospitality industry, and protecting individual rights. Thus, in almost all cases outdoors, and under limited conditions indoors, pollution caused by tobacco products is accommodated.
Due to the above dominant storyline "Cars are a necessity for life and the economy." it then follows that the pollution cars emit is seen as a necessary trade-off for economic prosperity and to meet the demands of life. Thus, we can see storylines which attempt to justify this pollution by minimizing it, pointing to the economic benefits of cars or the car industry, arguing that future technology will significantly improve it, or focus on how to avoid exposure to it - rather than address it. However, even the strongest storylines cannot dispute the recorded harms of urban air pollution in the City from automotive and tobacco sources, which gives rise to DS2: Some polluting products must be `accommodated' in urban life.

DS3 **Combustion is the problem.**

Several actors have rallied around tech solutionism as the key to unlocking clean air. The most promising technologies to do so in both industries forgo combustion. Respectively, HTP's and Vapes, and EV's. The strongest proponent of this storyline is the national government to address air pollution from automotive sources, and industry to address air pollution from tobacco sources. The City supports this approach for EV's but to a lesser extent than the national government. While the Danish auto industry (De Danske Bilimportører) directly correlates sales of EV's to the green mobility transition, the AECA is more reluctant, instead preferring to focus on improvements in the ICE to address air pollution. Both governments do not support this storyline to reduce air pollution from tobacco sources.

A prominent example of actions that follow this storyline can be seen in the way that the National government incentivises EV use in urban areas by allowing them to use bus lanes. This is a strong endorsement of the belief that EV's can offer comparable air quality and climate benefits as public transportation. As noted in the analysis, this supports the electromobility grand narrative – as proposed by Holden et al. (2020). Which does not demand less mobility or politically unpalatable lifestyle changes to achieve SUM.

This dominant storyline was also seen shaping narratives found in the literature review. For example, within C40's Green & Healthy Streets Accelerator. Signatories of this initiative including Copenhagen have pledged to make a major area of their city zero-emission. This pledge is shaped by this dominant storyline, as well as DS1 above, as it focuses on EV's to address air pollution rather than pedestrianization or mode shift.

7.3 Further Research

Here the researcher will suggest some avenues of further research that this thesis has stimulated but was unable to explore due to time or data constraints.

The above research has identified the propensity of the City of Copenhagen to focus on a positive communication style and storylines. However, much research suggests that the best results in achieving sustainable transitions rely on a combination of both 'carrot' and 'stick' approaches (Xiao et al. 2021). The right balance to this must be carefully considered, but by underutilizing 'stick' approaches the City may be leaving some of its tools on the shelf in producing the rapid changes demanded by a new understanding of the health harms of air pollution. Therefore, a study to determine if there is a more appropriate balance of these two motivational approaches for the City to produce sustainable transformations may be warranted.

One such 'stick' approach may be found in the linking of driving and the second largest risk factor for public health in Denmark, lack of physical activity (Sundhedsstyrelsen 2023b). Although smoking is most often considered as a public health crisis primarily for the users, and only secondarily for those exposed second-hand smoke, the use of cars is considered a public health crisis only in terms of the pollution that they produce. To this end, when determining mobility infrastructure spending in Denmark the positive health impacts of biking are included in the analysis, but the negative health impacts resulting by lack of physical activity demanded by driving are not included. Including these impacts into infrastructure spending models, as a 'stick' to pull citizens away from behaviours that not only produce toxic air pollution but require sedentary behavior, could produce a rapid mode shift to non-polluting, active modes of transportation.

Additionally, much of government's storylines structured around smoking are aimed at driving generational change and avoiding normalizing smoking and exposure to second-hand smoke. This could be an interesting storyline to consider reducing other polluting activities, such as driving. If the next generation did not normalize driving, especially in areas with readily available mobility alternatives, then more dramatic action to reshape mobility with a more human perspective could be within reach.

As an alternative method to those used in the paper above, controversy mapping could have also been used. Controversy mapping is a process of analysing complex socio-technical debates. A controversy transcends a simple discussion where actors 'just' have opinions about a question (Munk 2020). The result is of a controversy mapping analysis is typically a diagram which uses a visual representation to highlight the connections between different elements of the controversy. For example, it can visually show the relationships between stakeholders, events, arguments, and evidence. The results by employing this method could be a further the findings of this paper in a more visual method.

The prevalence of tobacco smoking in Copenhagen has plummeted since the late 1990's due in part to concerns of the health impacts of second-hand smoke (poor air quality). Further research could be done to study what parallels and implications, if any, does this rapid change have for private automotive use (itself a major source of poor air quality).

Are there for example overlaps between traffic evaporation theory and smoking bans? Does the switch to combustion-less products in both industries hold any parallels – would a societal shift to EV's offer hidden dangers in the same way that vaporisers have helped new young users start using tobacco or nicotine products? Vapes are also presented by some as a smoking cessation device to wind-down a challenging addition. Are there any opportunities for EV's to be framed in the same way as a less harmful alternative to driving as a temporary measure until society learns better and more sustainable mobility habits? Furthermore, there are talks of a tobacco 'endgame' in Denmark and other countries whereby the product will be made illegal to sell to those born after a specific year. Should the same be proposed for the widespread use of private automobiles? Tobacco companies also claim that they do not work to increase the number of smokers or to grow the total market for tobacco or nicotine products, only increase the market share of their products. As several studies have now shown a need for a reduction in private car use to address climate change, should there be a similar 'cap' put on developed nations such that auto manufacturers do not work to increase the total mobility of a society? These, and other, questions would provide a rich field of exploration in future research.

Finally, the addition of the citizen's storylines and perspectives would have been a strong addition to this research. This could be facilitated through semi-structured interviews and would further deepen the research question to study alignment and dis-alignment between citizens, government, and the industry.

8 Conculsions

Air pollution is the largest environmental health threat globally and within Europe (CREA 2020; WHO 2022a). Within the city of Copenhagen, despite enjoying an international profile of a leading sustainable city and public health leader, ambient air pollution causes over 4 billion DKK (~537M EUR) in public health expenditures and approximately 550 premature deaths annually (City of Copenhagen 2021b).

One of the primary causes of poor urban air quality within Copenhagen is road traffic (Aarhus University 2021 as cited in City of Copenhagen 2021b). Despite improvements to the combustion engine from the 1970's, the auto industry has thus far failed in it is aim to create 'virtually pollution free engines'. While the EV transition holds promise to address urban air pollution, there remain questions surrounding PM emissions and the timescale on which this transition will be achieved.

Cars, party due to their utility in mobility, and partly due to decades of impressive storytelling by the industry remain a particularly hard source of pollution to address. Cars are so strongly embedded in global culture that Walker et al. (2023) has defined a term to describe the entrenchment: motonormativity. Motornormativity suggests that: "...we have a cultural inability to think objectively and dispassionately." when considering the benefits and drawbacks of the widespread use of private automobiles (Walker, Tapp, and Davis 2022).

To explore this, a comparison is drawn between two polluting industries. Looking to the past, the unrestricted use of other polluting products which previously enjoyed a culturally protected status, has been revoked in the name of public health. This is referring to tobacco products, which when smoked, release a slurry of harmful pollutants to the surrounding air, typically referred to as second-hand smoke or passive smoking. This pollution is known to cause approximately 900 deaths in Denmark or approximately 90 deaths in Copenhagen annually. Despite impacting far fewer residents, creating this form of air pollution by smoking is heavily regulated. The comparison between tobacco sources of air pollution and automotive brings about several interesting converging and diverging parallels.

Taking inspiration from the argumentative discourse analysis, and using an abductive approach combining a literature review and a documents analysis, this paper has analysed the storylines presented by government and industry actors to answer the following research question:

How do national and municipal government storylines addressing urban air pollution from automotive and tobacco sources in Copenhagen align or differ from those of industry?

To help answer this question two sub-questions are also answered. Conclusions from the two sub-questions will be presented below before finally answering the research question. Sub question 1 states:

SQ1: What are the dominant storylines and how do these implicitly shape storylines used by different actors?

The first identified dominant storyline: Cars are a necessity for life and the economy, is heavily promoted by the car industry and accepted and mirrored by the national government. The City of Copenhagen does not utilize this dominant storyline however, their storylines are heavily influenced by it. Based on the theory provided by Hajer (2006), this dominant storyline is shown to exert power over the City. In response to this the City has formed a storyline coalition titled 'The invisible car'. This collection of storylines avoid focusing on reducing car use in the City to bring about desired changes to sidestep debates for-or-against a motonormative society.

The second identified dominant storyline: Some polluting products must be 'accommodated' in urban life is also supported by all actors, notably in the name personal freedoms and the economy. Both industries have argued that limiting the use of their products is an unacceptable encroachment onto these rights. The national government has mostly agreed with this storyline for air pollution from automobile sources, with a long-term view to reduce urban air pollution with technological fixes (EV's). With air pollution from tobacco sources, the national government has espoused a balanced approach, aiming to balance public health with individual rights and the economic returns of the hospitability industry. The City weakly supports this storyline with a focus on measures to reduce exposure to air pollution from automotive sources, thus implicitly accepting the accommodation premise of the dominant storyline. The City has also argued that outdoor exposure to second-hand smoke must be tolerated to protect personal freedoms.

Therefore, the accommodation of both sources of air pollution has a major influence all actors storylines. The industry strongly pushes this storyline which is then presented in national government sources, albeit with a more balanced approach (e.g., car pollution must be accepted - but aims to switch to EV's to reduce it. Or the rights of tobacco users to smoke must be protected - but within limits). There is a stronger environmental

governance approach within the City when compared to the national government. However, the City ultimately accepts many aspects of this storyline as it aims to protect public health based on minimizing exposure to, rather than reducing, pollutants.

The final dominant storyline is Combustion is the problem. This storyline is strongly endorsed by the tobacco industry for second-hand smoke, and the national government and the City when addressing automotive pollution. It was also found to be supported by C40, an actor outside the scope of this research paper but found in the literature review. This storyline argues for a particular brand of techno solutionism to address poor urban air quality. As a drop-in replacement for older combustion technologies, non-combustion alternatives offer a way to reduce air pollution while avoiding politically unpalatable discussions surrounding a need for lifestyle change. As such, this dominant narrative is typically employed by those who do not wish to perturb the status-quo of car and tobacco use. The European auto industry largely supports this storyline but is careful not to alienate their most profitable product line – the ICE car. The Danish auto industry more strongly supports this storyline.

Research sub-question two asks:

SQ2: Do any of the storylines employed give a deeper understanding into the actor's internal understanding of the role that private automobile use or tobacco products occupy in society?

From the viewpoint of the industry, both automobiles and tobacco products hold a significant place in society (DS1). The industry views these products as vital for as expressions of personal choice and contributing to a prosperous economy and modern life (DS1). Their stance highlights how essential these products are, often suggesting they offer a form of respite or a key component of daily living.

From a national governmental perspective, the necessity of private car use for daily life and the economy is accepted and promoted (DS1). There are no suggestions of reducing personal car use to address air pollution. Correspondingly, the EV transition is presented as the primary pathway to reduce air pollution (DS3). Tobacco use, on the other hand, is viewed as a personal choice. Too severe restrictions on its use could infringe on individual rights and potentially harm the economy, specifically the hospitality sector (DS2).

From the City's storylines, private car use is seen as a part of everyday life. However, recognizing the air quality implications, the city promotes sustainable alternatives such as biking to shift the reliance away from personal automobile use. It also offers ways to reduce exposure to the pollution they produce (DS2). The City views smoking as semi-protected personal expression. Aiming for storylines with broad stakeholder consensus,

it offers a package of voluntary pathways to help users quit smoking, and non-binding suggestions on smoke-free areas (DS2).

Summarizing each actors' storylines, industry actors use storylines which argue that restricting the use of these products will lead to socioeconomic unrest. They emphasize the need for more of their new products to address air pollution. These storyline coalitions are anchored in anthropocentric principles, wherein the exploitation of natural resources, the prioritization of growth maximization, and a proclivity towards market-oriented solutions collectively facilitate the perpetuation of the status quo.

While speaking to second-hand smoke, the national government focuses on storylines which stress the protection of the next generation, while balancing individual rights and industry economic interests. When looking at urban air pollution from automotive sources the government remains outwardly ambitious, keen to present Denmark as a leader in the sector on the international stage and minimizing the current state of urban air pollution in Copenhagen. Despite concerns that EV's will continue to release harmful PM, National government storylines coalesce around facilitating a rapid shift towards EV's away from ICEs. Ambitious EV deployment is presented as an integral part of the solution to meet climate targets and address air pollution. These storylines are facilitated by the national government endorsement of the dominant storyline: "Cars are a necessity for life and the economy".

The City of Copenhagen is uncovered to prefer positive communication styles and avoids speaking against the first dominant storyline. Instead, the city emphasizes an approach where positive alternatives are provided to users to reduce exposure pollution, on a voluntary basis. Their storylines speaking to urban air pollution from tobacco sources emphasize that no restrictions will be imposed on those who do not wish to stop smoking as a matter of protecting personal freedoms. The City does not use the dominant storyline, "Cars are a necessity for life and the economy", however speaks in circles around it. This can be seen through the coalition of storylines titled by the researcher as 'the invisible car'. The City endorses EV's but to a lesser extent than the national government.

In conclusion, both the tobacco industry and the automotive industry are shown to be the principal creators of most dominant storylines, speaking to the power of these industries. National government storylines are closely aligned with industry in both causes, especially the automotive industry, although they typically offer a more balanced viewpoint. The City's storylines align with those of the industry's at times and diverge in others. As industry narratives have been used to create the dominant storylines, the City is limited from using an anti-motonormativity storyline to advance it is agenda.

Despite a much greater impact on Copenhagen society, air pollution from cars is regulated to a far lessor extent than air pollution from tobacco products. Actors use a variety of storylines support justification of this. Some of these storylines are woven together to support a particular worldview, others mimic storylines inspired by similar industries, and some support, or must otherwise circumnavigate dominant storylines. Industry storylines are shown to highly influence in government storylines, which may result in the continuation of adverse public health outcomes in Copenhagen.

These results are useful for any actor who wishes to address urban air pollution, especially air pollution from automotive sources. Ultimately, this paper advocates for robust public debate to re-define an optimal equilibrium between the public health implications deriving from the pervasive use of private automobiles and the functionality they offer.

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