

Baran Kızılırmak

Criminal Liability in Offenses Involving Autonomous Systems Driven by Artificial Intelligence



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Dedicated to my mother and father...

Preface

This book constitutes the published version of the doctoral dissertation of the same title, prepared under the supervision of Prof. Dr. Dr. Eric HILGENDORF and awarded the distinction of *summa cum laude* by the Faculty of Law at the University of Würzburg.

Since antiquity, humanity has crafted narratives centred on the fear of losing control to non-human entities. Today, perhaps for the first time, we find ourselves on the threshold of witnessing the realisation of such narratives: we are no longer confronting mere puppets; instead, we are engaging with *Pinocchio*, who has transcended his strings.

This book engages with one of the most pressing challenges facing contemporary (and likely also future) criminal law: Who bears liability when an AI-driven autonomous system is involved in a criminal offence? It approaches this question from the perspective of German criminal law, with the aim of providing concrete answers, particularly in relation to the negligent liability of the person behind the machine. In this context, it further examines whether it is possible to classify the risky activities of such systems, which possess the potential to yield significant benefits for society, as permissible; thereby resulting in a situation where no one is held liable.

The research was mainly conducted between 2020 and 2025, a period marked by the rapid evolution of AI technologies. Consequently, the examples examined were repeatedly updated and revised. While the creation of avocado-shaped chairs by GPT was met with fascination, the production of films indistinguishable from reality has become almost ordinary. Nonetheless, the analysis offered here will remain relevant unless (or until) we witness a fundamental paradigm shift in which humans completely relinquish control, as at the heart of liability lies control. Accordingly, rather than focusing on a specific AI application, the study takes a step back to explore, within the framework of criminal law doctrine, how responsibility is affected when human control is partially or entirely assumed by autonomous systems. For this reason, the emphasis is placed not so much on AI itself, but on the concept of autonomy.

This work began with a question that first occurred to me in 2017. At the time, I had not yet completed my master's thesis, and as I lacked the necessary proficiency to address this topic within the framework of criminal law dogmatics, I needed to further develop my knowledge. Upon com-

mencing my doctoral studies at *Galatasaray University* (Turkey) in 2018, I started taking notes regarding the subject. Later, thanks to two scholarship programmes and a series of fortunate coincidences, life brought me to *Würzburg*, to work alongside the most distinguished scholars in the field, **Prof. Dr. Dr. Eric HILGENDORF**, renowned not only in Germany, but also across Europe and beyond for his work on AI and criminal law. I am truly grateful that it happened this way, as my time in *Würzburg* has been immensely enriching. I owe my deepest thanks to my *Doktorvater*, who, despite an exceptionally demanding schedule, always found the time to respond to my questions and played a vital role in the development of this dissertation. I am also sincerely grateful to the **University of Würzburg**, its academic and administrative staff, for their constant support and warm hospitality. Of course, I would also like to extend my deepest thanks to **Prof. Dr. Tobias REINBACHER**, who generously devoted time to reading my -admittedly lengthy- dissertation and kindly prepared a detailed *Gutachten*. Both *Gutachten* contributed significantly to the completion and eventual publication of this work.

One of the main difficulties I faced at the beginning was the absence of an established body of literature on the subject. Of the few existing works, some were heavily influenced by science fiction, relying on speculative arguments that lacked grounding in legal reality. Others, by contrast, dismissed the significance of the issue altogether, suggesting there was no legal problem worth analysing. As a legal scholar, understanding the technological aspects of the subject presented another significant challenge. I spent a considerable amount of time familiarising myself with the technical dimensions to identify where precisely the legal issues, particularly from the standpoint of criminal law exist. During this period, I also improved my German, which enabled me to engage more thoroughly with the relevant legal literature.

The book is written primarily from the perspective of German law. However, given the substantial overlap with Turkish law, it is of use within both legal systems. Moreover, as it is written in English, it may also serve as a valuable resource for readers from the Anglo-American legal tradition, who may be less familiar with the criminal law dogmatics prevalent in Continental Europe. Where relevant, the study also highlights points of convergence and divergence between these legal traditions.

Although being relatively lengthy for a doctoral thesis, the descriptive sections have been kept brief. However, certain foundational issues (such as negligence) are addressed in greater depth to engage readers from the

Anglo-American legal tradition. Theoretical discussions are not abstractly presented; rather, they are contextualised and illustrated with concrete examples closely linked to the subject matter.

This book was originally intended to be completed in 2023. However, various unforeseen difficulties delayed its finalisation. It is, after all, uncommon for a legal scholar studied in Turkey to pursue a doctorate in Germany under such circumstances. I owe an immense debt of gratitude to my family, who stood by me through every challenge encountered along this largely uncharted path. I have dedicated this book to them. Throughout my life, they have placed the highest value on my education and made every possible sacrifice to support. First and foremost, I am grateful to my mother for instilling in me a constant drive for self-improvement and a lasting curiosity to explore new horizons. If I possess a slight genuine passion for reading, research, and learning, it is undoubtedly due to her influence. I thank my father for teaching me the enduring virtues of honesty and integrity. I believe that even a single moment from the final stages of this project is enough to illustrate the principles he consistently upholds: during the exhausting final months, I worked no less than fourteen hours a day, every day. When the day came to submit the thesis, I worked through the night and printed the final draft using the printer in my university office, then had it bound and submitted. I called my father to share the news. He congratulated me warmly and, with characteristic sincerity, gently reminded me that it would be right to put back the paper I had used from the university supply - which, of course, I did. If I can live my life with even half the integrity he has shown, I will consider myself fortunate.

There are dozens of people to whom I owe thanks. First and foremost, I am deeply grateful to the **DAAD (German Academic Exchange Service)** for awarding me the scholarship that made it possible for me to pursue a doctorate in Germany. I am likewise thankful for the **Jean Monnet Scholarship**, among the most longstanding and prestigious scholarships in Turkey, which, through a fortunate series of events, opened a door for me to undertake my doctoral studies in *Würzburg*, the most suitable place for carrying out this research.

I am especially grateful to **Prof. Dr. Tuğrul KATOĞLU** and **Doç. Dr. Aysun ALTUNKAŞ**, whose unwavering support throughout this entire journey has been invaluable. I also extend my sincere thanks to all the dedicated academics at **Kadir Has University**, who continue to stand in solidarity despite increasingly difficult circumstances. I am truly lucky and proud to have been part of this university for many years. My sincere

thanks go to **Dr. Onur Çağdaş ARTANTAŞ**, who has always walked one step ahead of me, lighting the way down this path. I am equally grateful to **Lauren NORMAN**, who undertook the meticulous proofreading of this work with great care. I would also like to thank **Maximilian HELL** for proofreading the German summary, and for being not only one of the most talented individuals I have had the pleasure of knowing, but also a true friend. Also, I owe special thanks to **Dr. Dr. Leandro Dias**, whose guidance on the procedures and constant encouragement whenever he saw my work have been invaluable. Finally, I am also deeply grateful to all the friends and colleagues, who stood by me throughout the long and demanding process of preparing this thesis. Their constant support meant more than words can express. I am truly fortunate to have them.

I am also thankful to have been taught by many teachers throughout my life who upheld essential virtues and progressive values. While I cannot name each of them here, I sincerely thank all the teachers who have, in various ways, contributed to my learning journey. And of course, I would also like to express my sincere thanks to **Nomos Publishing, Dr. Marco GANZHORN** and **Miriam Moschner** for all their support.

Finally, I would like to extend my heartfelt thanks in advance to all readers who take the time to engage with this book. Undoubtedly, the study contains shortcomings, and I would be genuinely grateful for any feedback or criticism you may wish to share. You are always welcome to contact me at kizilirmak.baran+book@gmail.com.

With the hope of a peaceful world in which humans and artificial beings coexist in harmony!

Würzburg, August 2025

Baran KIZILIRMAK

Table of Contents

List of Abbreviations	19
Introduction	23
Chapter 1: The Complexity of Liability for Crimes Involving Autonomous Systems Driven by Artificial Intelligence	29
A. Legal Challenges	29
B. AI-Driven Autonomous Systems in Daily Life: A New Normal	31
C. Conceptual Framework	33
1. Automation - Autonomy	33
2. The Turing Test	33
3. Bot - Robot	34
4. Artificial Intelligence	35
5. Machine Learning	37
D. Addressing Liability: Key Actors and Entities	39
E. Distinctive Challenges of Crimes Involving AI-Driven Autonomous Systems	45
1. Ex Ante: Autonomy and Diminishing Human Control	46
a. Origins of the Term 'Autonomy'	46
b. The Intellectual Background to the Concept of 'Autonomy'	47
c. Automation vs. Autonomy	49
d. Emergence Instead of Autonomy	52
e. Autonomy and the Transformation of Human Control	53
f. Lack of Predictability in AI-Driven Autonomous Systems	56
2. Ex Post: Opacity and Explainability in AI Systems	58
Chapter 2: The Occurrence of Criminal Incidents Involving AI- Driven Autonomous Systems	65
A. Types of Criminal Offences Likely to Emerge	65

B. Categorical Distinction of Crimes Involving Autonomous Systems	67
1. Various Classifications in Literature	67
2. Intentional Use of Autonomous Systems to Commit a Crime	68
3. Crimes Against Autonomous Systems	69
4. Crimes Caused by Autonomous Systems	70
C. Prominent Cases Highlighting AI-Related Liability	71
Chapter 3: Doctrinal Approaches to Liability Models in the Literature	79
A. Bridging Contested Liability Gaps in Criminal Law	79
B. Autonomous System's Own Liability	81
1. Fundamentals	81
2. The Legal Debate on Personhood for AI-Driven Autonomous Systems	85
a. Pro Arguments in Legal Literature for AI-Personhood	85
(1) The Origins	85
(2) Anthropomorphising Robots	86
(3) Pragmatical Necessities	88
(4) Defining the Nature and Scope of Legal Personhood for Robots	90
(5) The Impact of Robotic Liability on the Responsibility of the Person Behind the Machine	92
b. Contra Arguments in Legal Literature Against AI-Personhood	94
c. Synthesis and Evaluation	96
3. Can Autonomous Systems 'Act' In the Legal Sense?	101
a. General Insights	101
b. Assessment Based on Theories of Action	103
c. Re-interpretation of the Concept "Action"	108
C. Various Liability Models for the Person Behind the Machine	110
1. Can Civil Law Liability Models be Adapted to Criminal Law?	112
a. Fault-Based Torts Liability	114
b. Vicarious Liability	118
(1) Respondeat Superior	118
(2) Exploring Existing Frameworks: Slavery, Animal Ownership, Employees and Associates	121

(3) Applying Vicarious Liability in Criminal Law	124
c. Strict Liability	126
(1) Strict Liability Over Fault-Based Liability	126
(2) Does Strict Liability Incentivise Harm Mitigation Initiatives?	128
(3) Defining the Scope of the Strict Liability Regime	130
(4) The EU AI Liability Directive (AILD) and Strict Liability Regime within the EU	133
(5) Compatibility of Strict Liability with Criminal Law Principles	136
d. Product Liability	138
(1) Introducing Product Liability for AI-Driven Autonomous Systems	138
(2) Responsibility Shifting to Manufacturers	140
(3) The Essence of Product Liability	141
(4) Manufacturer's Duties	142
(5) Specific Challenges for AI-Driven Systems in Product Liability	145
(6) Criminal Product Liability	148
(a) The Rationale Behind Criminal Product Liability	148
(b) General Duties of Manufacturers in the Context of Criminal Product Liability	150
(c) Key Judicial Decisions Shaping Criminal Product Liability	152
(d) Unique Challenges of AI Products and Criminal Product Liability	155
2. Indirect Perpetration	157
a. Pro Arguments for Indirect Perpetration in AI-Driven Autonomous Systems	157
b. Theoretical Basis of Indirect Perpetration	160
c. Assessment	161
3. The Natural Probable Consequence Liability Model	164
Chapter 4: Criminal Liability of the Persons Behind the Machine	167
A. Causality	168
1. General Challenges with the Causal Nexus for Autonomous Systems	168

2. Legal Theories of Causality: Implications for AI-Driven Autonomous Systems	172
a. Assessment Based on Causality Theories	172
b. Distinctive Challenges with Causality	179
B. Intentional Liability	181
C. Negligent Liability	185
1. The Rationale Behind the Concept of Negligence in Criminal Liability	185
2. Advancing Technologies and Negligence	186
3. Theoretical Foundations of Negligent Liability in AI-Driven Autonomous Systems	188
a. Fundamentals	188
b. The Legal Basis of Duty of Care	194
c. Under Which Perspective Should the Standard of Care Established?	200
d. Negligent Undertaking	207
e. Insights from Turkish Law on Negligence and the Scope of the Duty of Care	210
4. The Scope and Boundaries of Duty of Care for the Person Behind the Machine	213
a. The Boundaries of Foreseeability	214
(1) Recognising the Unforeseeable	214
(2) Learning from Mistakes and Hindsight Bias	217
(3) Objective Foreseeability, Typical Risks and Laplace's Demon	218
b. Compliance with the Duty of Care: The Scope and Key Obligations	222
(1) The Anatomy of Failures in AI-Driven Systems	223
(2) Challenges in Defining Standards of Conduct for Emerging Technologies	224
(3) The Application of the General Duty of Care	226
(a) Defining the General Duty of Care	226
(b) The Duty of Care Stemming from Increasing Risks	227
(c) Obligations Arising from System Failures	228
(d) Duty to Ensure Robust System Design	230
(e) The Protective Purpose of the Norm	232
(4) The Evolution of Duty of Care Through New Techniques	234

c. Human in the Loop	237
d. Control Dilemma	239
5. The Permissible Risk Doctrine	241
a. Conceptual Framework	241
(1) The Concept of “Permissible Risk”	241
(2) Debates on the Legal Nature of Permissible Risk	244
(3) The Role of Permissible Risk in Limiting the Duty of Care	250
(a) Underlying Premise: Risks are Inevitable	250
(b) Mitigating Risks to Permissible Thresholds	252
(c) The Impact of Permissible Risk on Negligent Liability	256
(d) Does Permissible Risk Cover Atypical Risks of AI?	259
b. Recognising Permissible Activities: Legal Criteria and Analysis	265
(1) Risk-Based Approach	265
(a) Determining the Appropriate Risk Approach	265
i. The Concept of Risk	265
ii. The Balance Between Risks and Societal Benefits	267
iii. Calibrating the Duty of Care Through Risk Levels and Public Tolerance	268
(b) The Relationship Between Social Adequacy and Permissible Risk	273
(c) Society’s Willingness to Tolerate Risks	277
(2) Assessing the Acceptability of Risks in AI-Driven Autonomous Systems	281
(a) Balancing Risks and Benefits	281
(b) Societal Gains of AI-Driven Autonomous Systems	284
(c) Potential Threats Posed by AI-Driven Autonomous Systems	290
(3) The Impact of Employing AI-Driven Autonomous Systems on Existing Risks	295
(a) Substituting Existing Risks	295
(b) Risk Enhancement through Task Delegation to AI-Driven Autonomous Systems: A Legal Analysis	299
(c) Does the Non-Use of AI-Driven Autonomous Systems Breach the Duty of Care?	304

(d) Delegating Tasks to AI-Driven Autonomous Systems: An Alternative Approach for Liability	307
c. The Feasibility of Defining Permissible Risk Through Standards and Other Norms of Conduct	310
(1) Concretising Legal Expectations	310
(2) Positive Law's Reference to the State of the Science and Technology	315
(3) The Effectiveness of Norms Established by Private Entities on the Duty of Care	319
(4) Compliance with Norms: An Indicator of Fulfilling the Duty of Care	322
(5) The EU AI Regulation (AI Act) and the Imposed Duty of Care	328
D. Criminal Liability Involving Multiple Actors and The Problem of Many Hands	334
1. The Concept of "the Problem of Many Hands"	334
2. The Principle of Reliance	335
a. The Concept	335
b. The Problem of Many Hands and AI-Driven Autonomous Systems	339
(1) Liability Challenges in the Production Chain of AI-Driven Autonomous Systems	340
(2) Other Instances of the "Problem of Many Hands" in Relation to AI-Driven Autonomous Systems	346
c. Introducing AI-Driven Autonomous Systems into the Principle of Reliance	349
(1) Should Humans Rely on Machines?	350
(2) Should Autonomous Systems Rely on Humans?	353
(3) Should AI-Driven Autonomous Systems Rely on Each Other?	360
E. Dilemma Challenges	361
1. Exploring the Origins of Moral Dilemmas	361
2. The Dilemma for Self-Driving Vehicles	362
a. How Does it Emerge?	362
b. The Balancing of Interests	365
(1) Comparison of Values	365
(2) Assessment of the Utilitarian Approach to Dilemmas	370

(3) Proximity of Danger, Impact of Predictable Decisions and Random Generator	373
3. Legal Frameworks Applicable to Dilemma Situations	377
a. Analysis under German Law	378
(1) Necessity as Justification (StGB Section 34)	378
(2) Necessity as Exculpation (StGB Section 35)	382
(3) Supra-Legal Excusable Necessity	385
(4) Conflict of Obligations	389
b. Analysis under Turkish Law	393
4. Evaluation: An Alternative Approach	397
 Chapter 5: Suggestions for De Lege Ferenda	 405
A. Placing Dangerous Products on the Market as an Endangering Offence	405
B. Certain Jurisdictions Concretising Criminal (Non-)Liability For AI-Driven Autonomous Systems	411
 Conclusion and Extended Summary	 415
 Summary	 443
 Zusammenfassung (Summary in German)	 447
 Bibliography	 453

List of Abbreviations

AE	Alternative Entwurf
AGI	Artificial General Intelligence
AI	Artificial Intelligence
AILD	Artificial Intelligence Liability Directive
ALIC	Actio Libera In Causa
ANNs	Artificial Neural Networks
API	Application Programming Interface
Art.	Article
BAST	Bundesanstalt für Straßenwesen (Federal Highway Research Institute)
BGB	Bürgerliches Gesetzbuch (German Civil Code)
BGH	Bundesgerichtshof (Federal Court of Justice)
DAN	Do Anything Now
DIN	Deutsches Institut für Normung (German Institute for Standardization)
DNN	Deep Neural Networks
DOS	Denial of Service
DVGW	Deutscher Verein des Gas- und Wasserfaches (German Technical and Scientific Association for Gas and Water)
e.g.	Exempli gratia (for example)
Ed.	Editor
Eds.	Editors
EEC	European Economic Community
ESP	Electronic Stability Program
et al.	Et alii (and others)
etc.	Et cetera
EU	European Union
f.	Following page
FDR	Flight Data Recorder
ff.	Following pages
Fig.	Figure

List of Abbreviations

fn.	Footnote
GDPR	General Data Protection Regulation
GenTG	Gentechnikgesetz (Genetic Engineering Act)
GG	Grundgesetz (Basic Law of Germany)
GPAI	General Purpose Artificial Intelligence
GPT	Generative Pre-trained Transformer
HLEG	High-Level Expert Group on Artificial Intelligence
I.	Issue
i.e.	Id est (that is)
ISO	International Organization for Standardization
JA	Juristische Arbeitsblätter
KI	Künstliche Intelligenz (Artificial Intelligence in German)
LIDAR	Light Detection and Ranging
LLM	Large Language Model
MIT	Massachusetts Institute of Technology
ML	Machine Learning
MRI	Magnetic Resonance Imaging
NHTSA	National Highway Traffic Safety Administration
NJW	Neue Juristische Wochenschrift
Nr.	Number
NStZ	Neue Zeitschrift für Strafrecht
NZV	Neue Zeitschrift für Verkehrsrecht
NZWSt	Neuerscheinungen zum Wirtschaftsstrafrecht
OECD	Organisation for Economic Co-operation and Development
OLG	Oberlandesgericht (Higher Regional Court)
p.	Page
PCRC	Penal Code Review Committee
PLD	Product Liability Directive
pp.	Pages
ProdHaftG	Produkthaftungsgesetz (Product Liability Act)
RGSt	Reichsgericht in Strafsachen
Rn.	Randnummer (Margin number)
SAE	Society of Automotive Engineers

sci-fi	Science Fiction
StGB	Strafgesetzbuch (German Criminal Code)
StVG	Straßenverkehrsgesetz (Road Traffic Act)
StVO	Straßenverkehrs-Ordnung (Road Traffic Regulations)
TPC	Turkish Penal Code
TSE	Türk Standartları Enstitüsü (Turkish Standards Institute)
U.S.	United States
UK	United Kingdom
UN	United Nations
UNIDIR	United Nations Institute for Disarmament Research
USA	United States of America
V.	Volume
VDE	Verband der Elektrotechnik Elektronik Informationstechnik (Association for Electrical, Electronic, and Information Technologies)
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
xAI	Explainable Artificial Intelligence
ZIS	Zeitschrift für Internationale Strafrechtsdogmatik
ZStW	Zeitschrift für die gesamte Strafrechtswissenschaft

