

Hyperpersonalisation: a tailored online choice environment

In short Technological developments make it possible to personalise online choice environments, such as apps and websites. Content, tone, order and design can be tailored to consumer characteristics, preferences and behaviour. In its most advanced form, this is referred to as *hyperpersonalisation*. In this report, the AFM explores these possibilities, the current and future applications in the financial sector, and what this means for (the protection of) consumers. Compared to other sectors, personalisation of the choice environment in the financial sector is still limited, although financial firms indicate that they intend to make greater use of it in the future. By using personalisation, consumer attention and behaviour can be influenced in a more targeted and effective manner. This presents both opportunities and risks. The AFM considers it important that companies handle these new possibilities in a careful and responsible manner.

Contents

Summary	3	5. Responsible application	22
1. Introduction	5	5.1 Careful and responsible application by financial firms	22
2. (Hyper)personalisation of the online choice environment	10	5.2 Implications for supervision	24
2.1 Opportunities for personalisation of the online choice environment	10	6. References	25
2.2 Hyperpersonalisation: a fully tailored choice environment	12		
2.3 Personalisation increases the influence of the choice environment	14		
3. Application in the financial sector	15		
3.1 The first steps towards a tailored online choice environment	15		
3.2 Why (hyper)personalisation is still rarely used	16		
3.3 Financial firms aim to make greater use of personalisation in the future	16		
4. Opportunities and risks	19		
4.1 Personalisation offers opportunities to support consumers in making financial decisions	19		
4.2 Personalisation may have undesirable consequences for consumers	19		

Summary

The combination of large volumes of individual data and the use of artificial intelligence (AI) enables companies to refine customer profiles and personalise online choice environments with increasing precision. Content, tone, order and design can be tailored to consumer characteristics, preferences and behaviour. It is possible that elements of the online choice environment are no longer determined by a human, but by the outcomes of an algorithm. By making use of generative AI (gen AI), content creation can even be fully automated. In its most advanced form, this is referred to as *hyperpersonalisation* of the choice environment: real-time, data-driven, dynamic and fully tailored to the individual.

This AFM exploratory study indicates that financial firms intend to make greater use of personalisation of the choice environment in the future, although its current use remains limited compared to other sectors. The use by banks, investment firms and crypto service providers is generally limited to minor adjustments based on broad customer segments, such as age groups or customers with or without a mortgage. Initial steps towards more fine-grained and advanced applications focus on personalising the content of advertisements, notifications, email reminders and in-app banners. The design of the choice environment is still largely a human task. Financial firms may be held back by legal risks and uncertainties, as well as practical barriers – such as legacy systems that lack flexibility and limited scalability of personalisation. Financial firms participating in this exploratory study aim to further personalise the choice environment in the future and recognise the benefits of personalisation, for example for commercial purposes, customer retention and supporting healthy financial behaviour.

By personalising the choice environment, firms can influence users' attention and behaviour in a more targeted and effective manner.

This presents both opportunities and risks. Personalisation can be used to benefit consumers, for example by providing better support for financial decision-making, offering greater insight into one's personal financial situation and improving the user-friendliness of digital services. However, personalisation may also amplify the existing risk of adverse influence of the choice environment. It may also come with unintended side effects, such as negative effects on aspects not captured by the algorithm, reinforcing (prior) unwise decisions, and discrimination.

Conversational AI is expected to play an increasingly important role within online choice environments; in the future, it could even replace the traditional user interface entirely. This technology enables consumers to communicate with financial firms in a personal and accessible way. Conversational AI is expected to become increasingly sophisticated, shifting its role from a customer service chatbot to that of a fully-fledged financial assistant. Due to the automated and dynamic nature of this technology, new risks also emerge, including the risk of even more effective adverse influence. These risks warrant increased attention in the coming years.

The Dutch Authority for the Financial Markets (AFM) encourages financial firms to explore how personalisation of the choice environment can be used to promote sensible financial decision-making. It is important to handle these new possibilities in a careful and responsible manner. This means that firms should carefully weigh the application of personalisation and refrain from using it when it does not serve the customer's interests. When defining the objectives pursued through personalisation, commercial interests should never take priority over customer interests. In addition, it is important to actively monitor the impact of personalisation on (outcomes for) consumers, paying specific attention to unintended side effects.

The AFM notes that firms are rightly cautious about the automated use of gen AI in designing the choice environment. This allows firms to maintain control over content quality and limit legal risks. Additionally, it is important to give consumers meaningful control over the personalisation of the choice environment. This means that they should be able to decide at any time and for each application whether they want a personalised choice environment – supported by accessible settings and clear explanations.

It is important to respond in a timely manner to developments related to the personalisation of choice environments. These developments create new possibilities that sometimes lie near the legal boundary between information provision and advice. The AFM considers it important that financial firms have more clarity when personalisation falls within the boundaries of providing advice. The AFM will further explore existing uncertainties and act where necessary. Additionally, we also remain committed to accessible and targeted support for consumers in making financial decisions, with attention to the opportunities that personalisation offers.

Finally, the possibilities for personalisation of the choice environment raise new questions about the way in which the AFM conducts its supervision. Building knowledge is crucial for effective supervision. Through this and previous exploratory studies, we deepen and enrich our understanding of the opportunities and risks of digitalisation, AI and personalisation (AFM, 2024b, 2025b). The AFM will examine how to maintain adequate oversight and supervision of increasingly personalised online choice environments and their impact on consumers.

1. Introduction

Companies have increasing opportunities to personalise the online choice environment; in its most advanced form, we refer to this as hyperpersonalisation. Consumers are spending more and more time online, leaving behind a continuous trail of digital footprints. This data enables companies to build an increasingly detailed picture of the person in front of the screen. Combined with developments in artificial intelligence (AI), it becomes possible to personalise online choice environments – such as apps and websites – with greater precision. As a result, consumers no longer all see the same choice environment: content, tone, order and design can be adapted to individual characteristics, preferences and behaviour. It is even possible that the various elements of the online choice environment are no longer determined by a human, but by the outcomes of an algorithm. By using generative AI (gen AI), content creation can even be fully automated. In its most advanced form, this is referred to as hyperpersonalisation of the online choice environment: real-time, data-driven, dynamic and fully tailored to the individual.

Outside the financial sector, personalisation of online choice environments is already widely used. Examples include the Netflix interface that is tailored to users' viewing preferences, the TikTok feed that shows exactly what holds someone's attention, Booking.com that offers travel recommendations based on previous choices, or a webshop suggesting products purchased by similar consumers.

It is highly likely that personalisation – including in a financial context – will take increasingly advanced forms. Consumers are making more and more financial decisions online. Investing, saving, borrowing, insuring, making payments: almost all of it takes place through an app or website. As a result, financial firms have access to growing volumes of data. Based on this data, they can make predictions about the impact of adjustments to the online choice environment on different groups. Examples include a pension fund's online portal tailored to a participant's age, a banking app sending

specific notifications targeted at customers with investment accounts or an investment app adjusting the order of displayed products based on a customer's previous trading behaviour.

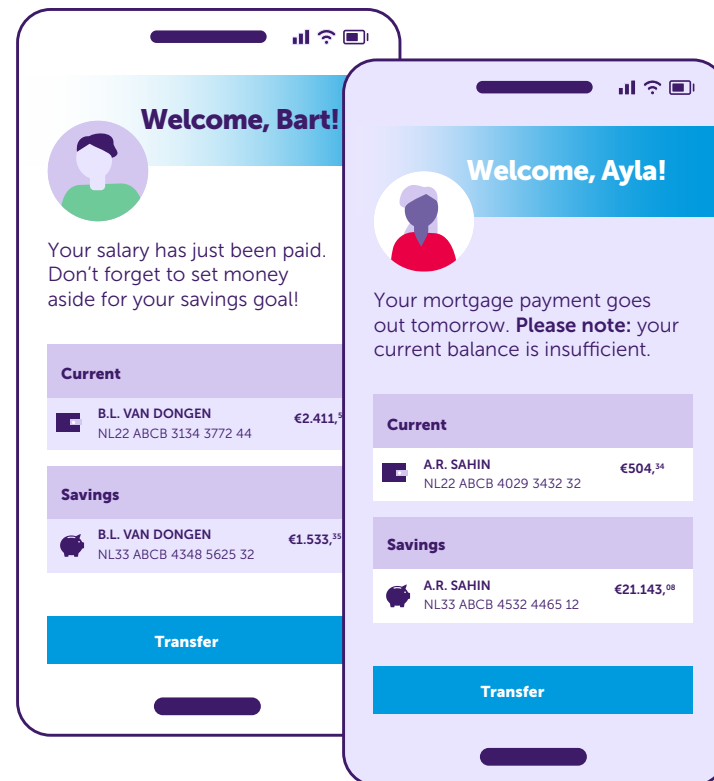


Figure 1.1. A fictional example of what personalisation in the financial sector might look like. In a banking app, customers receive different messages.

The influence of personalised choice environments on consumer behaviour is easily overlooked. Public and policy attention often focuses on the impact of AI applications in the financial sector that make *direct* decisions about or for individuals, such as credit scoring or algorithmic trading (AFM, 2023b, 2025b; DNB, 2024). Less attention is paid to the use of data and AI to personalise the choice environment. Such use does not directly lead to different outcomes for consumers, but can exert an *indirect*, subtle and often overlooked influence on their decisions (Fisher & Oppenheimer, 2025; Susser, 2019). Particularly because this form of influence is easily overlooked yet may have a significant impact on consumers, it warrants explicit attention. In recent years, the AFM has paid considerable attention to the influence of the – non-personalised – online choice environment. For example, we have conducted observational studies on the design of the online choice environment in investment and crypto apps (AFM, 2023a, 2024a). And we have called on the sector to ensure that the choice environment promotes sensible financial decisions (AFM, 2021a). With the introduction of the choice guidance standard for pension providers, the AFM has devoted explicit attention to the choice environment for pension participants (AFM, n.d.-a).

In this exploratory study, we examine the new opportunities emerging for financial firms to personalise or hyperpersonalise choice environments, and the associated opportunities and risks for consumers. We consider a broad spectrum of applications: from basic segmentation to advanced forms where an app adapts in real time to the behaviour of the individual user. Chapter 2 discusses the wide range of possibilities for (hyper)personalisation of the choice environment and its influence on consumer behaviour. Chapter 3 focuses on current and future applications in the Dutch financial sector. Chapter 4 outlines the opportunities and risks for consumers associated with (advanced) personalisation in the financial sector. The report concludes with recommendations for responsible use (Chapter 5).

The content of this report is based on academic publications, sector and policy reports and a series of interviews with experts, software providers and financial firms. The findings on current and future uses of personalisation are based on conversations with a select group of banks, investment firms and crypto service providers. They do not necessarily provide a complete picture of the Dutch financial sector. Although the insights are broadly applicable, this study focuses primarily on banks, investment firms and crypto service providers. These parties are expected to be the most advanced in personalising the choice environment, due to their access to relatively large volumes of customer data resulting from the high frequency of online customer interactions and transactions. The potential for personalisation may be particularly significant for these firms: given their broad and diverse product offerings, there is considerable variation in customer behaviour and ample opportunity to guide customers towards suitable products. That said, other financial firms – such as mortgage providers, pension administrators and insurers – also have opportunities to personalise the choice environment.



Figure 1.2 Two fictional examples of how personalisation in the financial sector might look like. (1) In an investment app, the same products are presented and highlighted in different ways, and the ease with which certain actions can be taken varies. (2) In a crypto app, the same information is displayed in different ways.

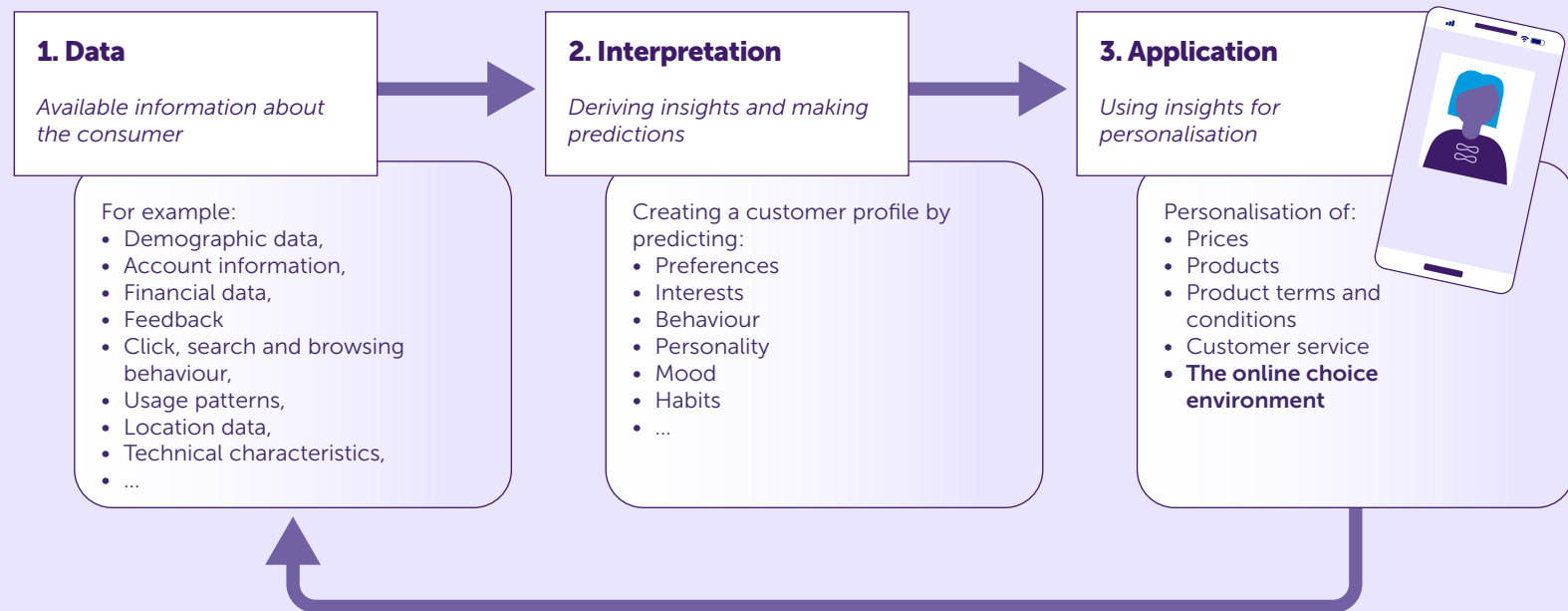
Box 1. The building blocks of online personalisation

Broadly speaking, personalisation requires three building blocks: data available at the individual level, the interpretation of this data and the application of these insights for personalisation. See the figure below for an overview of the building blocks (based on Strycharz & Duivenvoorde, 2021).

Building block 1: Data – the digital footprint

People leave behind a vast amount of data online. This is also referred to as the digital footprint. On the one hand, this concerns data that consumers explicitly share with firms and institutions, such as

demographic data (e.g. age, gender, place of residence), account information (e.g. preferences and settings), financial data (e.g. income, transactions, purchased products) or feedback (e.g. reviews, customer satisfaction surveys). On the other hand, there is a large amount of data that is continuously shared in a more implicit way, such as information about online click, search and browsing behaviour (e.g. previously viewed pages or products, viewing time, search terms), usage patterns (e.g. time of day, frequency), location data (e.g. IP address, GPS location) or technical characteristics (such as device type or browser). The increasing use of AI-driven chatbots creates a new source of extensive data. In addition, data can be enriched with contextual and other data, such as local weather conditions or sociodemographic information linked to a postcode.



Building blocks of online personalisation¹

1 Note: The structure presented in this figure may give the impression that the process of online personalisation consists of three static and separate components. In reality, online personalisation is continuously refined through experimentation, with consumer responses to personalised offerings being fed back into the model as data (Susser, 2019). This creates an ongoing feedback loop from application to data, enabling companies not only to improve their predictions but also to implement real-time adjustments (Lemmens et al., 2025).

Building block 2: Interpretation – understanding the person behind the data

The digital footprint can reveal a great deal about who someone is. Innovations in AI – including *machine learning*, *natural language processing* and gen AI – enable companies to identify patterns in data and predict preferences. Companies can make increasingly accurate assessments, also of aspects that individuals may not always be aware of themselves.

Initially, data was mainly used to predict customer behaviour and preferences; for example, the likelihood that someone would purchase or cancel a product (Ascarza et al., 2018; Chaudhuri et al., 2021; Haleem et al., 2022). However, due to the increased availability of individual data, it is now also possible to predict deep psychological characteristics (Matz & Netzer, 2017). Examples include inferring traits such as extraversion, openness, risk attitude, materialism, need for interaction and quality and price awareness based on various data sources, such as social media and smartphone usage, conversations with chatbots and financial transactions (Azucar et al., 2018; Blömker & Albrecht, 2025; Gladstone et al., 2019; Marengo & Montag, 2020; Peters et al., 2024a; Ramon et al., 2021; Shumanov & Johnson, 2021; Stachl et al., 2020; Tovanich et al., 2021).

Gen AI also makes it possible to use data types that were previously difficult to analyse – such as written text and photos – to estimate psychological and personal characteristics (Guenzel et al., 2025; Peters et al., 2024a). Even moods, emotions and sensitive information such as income, sexual orientation and political affiliation can, to some extent, be inferred from online behaviour (LiKamWa et al., 2013; Matz et al., 2019; Wang & Kosinski, 2018; Kosinski, 2021).

The accuracy of these estimates is certainly not perfect. It varies depending on the nature and quality of the data, the way models are trained and the extent to which data sources are combined (Azucar et al., 2018; Hinds & Joinson, 2024; Peters et al., 2024b). Some traits are also harder to observe and therefore more difficult to predict (Hinds & Joinson, 2024). There are also questions about the validity of certain estimates. For example, the Dutch Data Protection Authority (AP)

recently expressed concerns about models for emotion recognition (Autoriteit Persoonsgegevens, 2025). Despite these caveats, it is expected that estimates will become increasingly comprehensive and accurate over the next ten years, thanks to developments in (Gen)AI, the availability of even more fine-grained data and the integration of data sources (Matz, 2025).

Building block 3: Application – from insight to personalisation

Companies can use data and the insights derived from it to distinguish customer groups with similar characteristics. At the most basic level, this means dividing customers into a limited number of (often manually selected) segments or personas, for example based on age, satisfaction or shared preferences. Thanks to the increased availability of data and computing power, companies can combine data sources and analyse patterns. This enables them to move from static segmentation to more detailed, data-driven and even dynamic segmentation (Alves Gomes & Meisen, 2023). In the most advanced case, this no longer concerns customer segments but a profile at customer level (a ‘segment of one’, Olayinka, 2021).

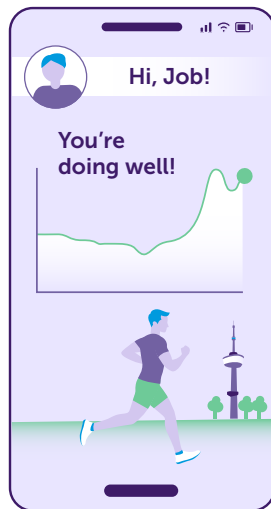
Firms can use these increasingly fine-grained segmentations to personalise the online choice environment. Other elements of the financial services process can also be personalised. For example, the AFM recently published on the personalisation of insurance premiums (AFM, 2024b, 2025a). We also published on the possibility that the credit process and offering will become increasingly personalised in the coming years (AFM, 2025b).

2. (Hyper)personalisation of the online choice environment

2.1 Opportunities for personalisation of the online choice environment

The design of the choice environment influences how people consider their options and which choices they ultimately make (AFM, 2021a). Designers can subtly steer people's attention and behaviour. This can be done, for example, by presenting certain options or considerations more prominently, or by making certain actions easier or more difficult. In this section, we discuss the many aspects of the online choice environment that can be adapted to align with insights about the user. Examples include personalising text and images, structure and design, and providing decision support (based on Münscher et al., 2016). Our focus is not limited to possibilities within the financial sector; we also examine applications in other domains, such as e-commerce, social media and entertainment.

Personalisation of text and visuals



An example of how personalization of text and visuals could be implemented.

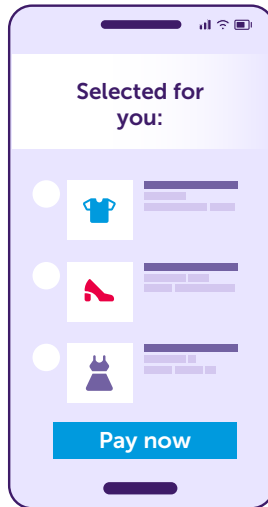
Personalisation of the choice environment usually starts by aligning textual and visual information more closely with the recipient. This includes adjustments in complexity, word choice, amount of text, tone or framing and the use of visual elements such as charts and figures. Many studies show that information is more persuasive and effective when the message aligns with an individual's personality, goals, needs or values (Hirsh et al., 2012; Joyal-Desmarais et al., 2022; Teeny et al., 2021).

In a simple form, this may involve adding someone's name to a message or targeting content at audiences to whom it is relevant (Farahat & Bailey, 2012; Peer & Mills, 2025). Examples include an advertisement for last-minute holidays shown only to people without children, to those who previously searched for such offers or to people living in regions with poor weather. Or an app that displays different messages to customers who recently created an account compared to those who have been customers for a longer period.

In a more advanced form, the displayed text is tailored to the individual recipient. A series of field experiments showed that online advertisements were much more persuasive and effective when they reflected the personality traits of specific customers, such as extraversion and openness (Matz et al., 2017). This microtargeting approach has also proved effective in the political context. Dutch research, for example, demonstrated that political messages are more convincing when they align with the recipient's personality traits (Zarouali et al., 2022). Another possible application is tailoring information to someone's sensitivity to certain types of argumentation, such as numerical evidence or emphasising social norms. Developments in gen AI make it possible to create personalised messages within seconds, which in many cases prove more effective than non-personalised, human-created versions (Hackenburg & Margetts, 2024a; 2024b; Matz et al., 2024; Teeny & Matz, 2024; Simchon et al., 2024).

(Gen) AI also enable the creation of advanced visual content – from images to virtual influencers – and tailoring this content to the recipient. For example, Netflix personalises the image used to recommend a film (Netflix Technology Blog, 2017). The same film may be shown to one user with a romantic image and to another with a humorous scene. Recent research on WhatsApp advertisements also showed that personalising videos based on previous purchases led to more customers clicking on them (Kapoor & Kumar, 2025).

Personalisation of structure and design



An example of how personalisation of structure and design could be implemented.

In addition to text and visuals, other elements of the choice environment can also be adjusted – such as which options are displayed, how they are presented and how easy it is to make a particular choice. This form of

personalisation is especially well known from entertainment and e-commerce platforms, such as Spotify, Amazon and Bol. These platforms assist users with personalised recommendations to help them discover new music or products. Behind the scenes, these *recommender systems* use data on user behaviour and preferences to predict the most suitable recommendations (Palomares et al., 2021; Raza et al., 2024; Roy & Dutta, 2022).

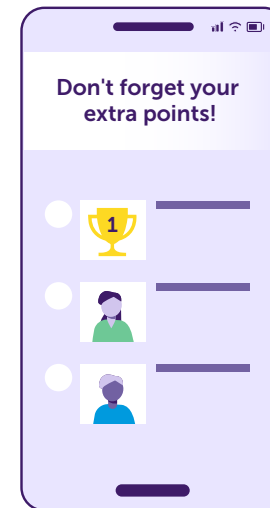
The recommended options are then prominently presented, enabling users to easily navigate the vast range of available

choices. Specific features that are relevant to an individual user may also be highlighted more prominently. This can result in certain options being harder to find for some customers.

Next to recommending specific options, companies can also tailor the number of options shown or the number of steps required to take action. For example, customers who are expected to have limited time or to make quick decisions may be shown fewer options (Long et al., 2025). A process can also be simplified by reducing the number of steps needed to complete an action. Common applications include prefilling previously provided information or skipping questions for which the answer is already known. Default settings can also be personalised, for instance by preselecting a payment method that a customer has used before or one that is presumed to be preferred.

Finally, companies can estimate the most effective timing and channel to bring a message or product to a customer's attention (Villanova et al., 2021). The timing and channel of suggestions can be adjusted based on previous behaviours, such as the time at which a customer has previously taken action. Other factors may also be considered, such as location or weather conditions that may increase the likelihood of certain behaviours (Peters et al., 2024).

Personalisation of decision support



An example of how personalisation of decision support could be implemented.

Personalisation can be used to support customers in making choices, for example by tailoring reminders or warnings to the individual's situation.

In this way, customers receive reminders or warnings only when they are most relevant. Research has shown, for instance, that alerts sent when customers were at risk of overdraft led to fewer customers incurring penalties (Ben-David et al., 2025).

Gamification – the use of game and competition elements – and online educational tools can also be personalised. Gamification elements, such as leader boards and symbolic rewards, can be displayed more or less prominently depending on the predicted sensitivity of a specific user to this type of stimulus (Bennani et al., 2021; Orji et al., 2018; Rodrigues et al., 2021; Tondello et al., 2017). Online educational tools can also be personalised using AI or gen AI to achieve better outcomes. For example, tailoring the style, difficulty level and learning process to the psychological characteristics of university students led to higher satisfaction, increased engagement and a greater proportion of completed tasks (Hu & Shao, 2025).

Chatbots and other virtual assistants based on gen AI offer particularly strong opportunities for advanced forms of personalisation. These *conversational AI* tools can support users in making choices, for example by providing tips or explanations, or by suggesting products that match what is known about the user. These tools can also adapt their communication style to the recipient (Shumanov & Johnson, 2021). Recent research even showed that a chatbot, with only limited demographic information about the recipient, was more effective in formulating persuasive and personalised arguments than a human (Salvi et al., 2025).

2.2 Hyperpersonalisation: a fully tailored choice environment

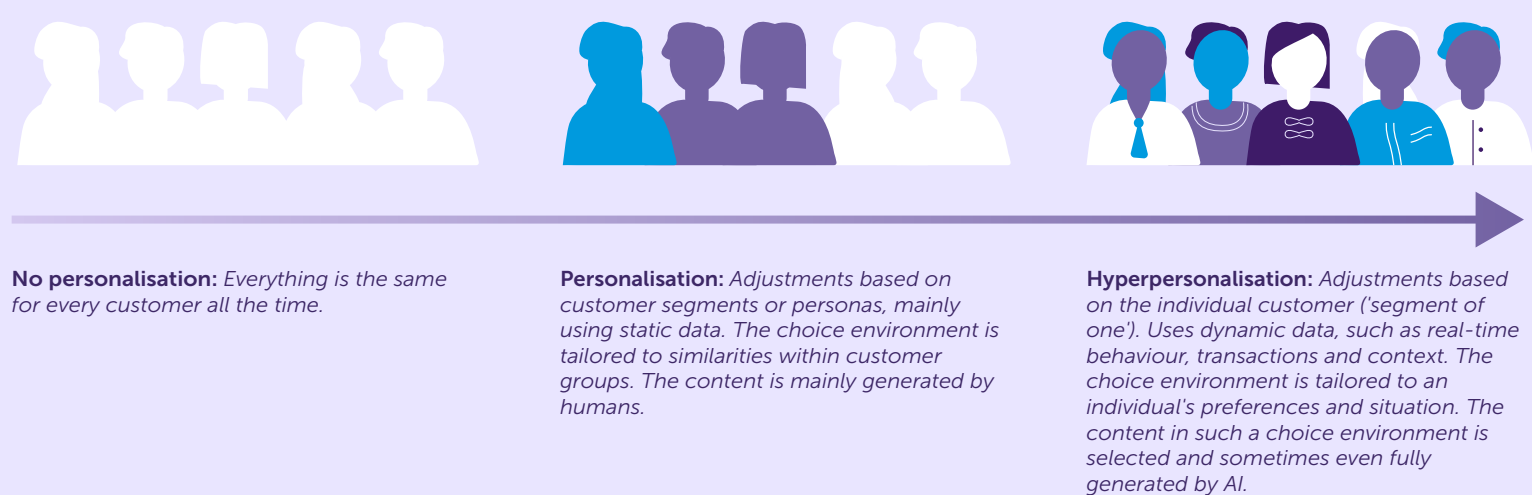
The elements described above form the foundation of a fully personalised choice environment and customer journey (Gao & Liu, 2022; Jesse & Jannach, 2021; Johnson, 2021; Sunstein, 2024). Personalised advertisements can attract new customers to use a platform or purchase a product. Tailored notifications can be used to draw users' attention to relevant features or products at the right moment. The structure and layout of an app or website can also be personalised: the order in which options are displayed, how they are categorised and which elements stand out most.

A further step is the personalisation of the entire user interface – the visual and functional design of the environment itself. This could include interfaces that better match the digital skills of older adults or the accessibility needs of people with disabilities, but also adapting an interface in such a way that it exploits a user's sensitivities (Wasilewski & Kolaczek, 2024). Technically, it is even possible to continuously adjust the entire design of websites and apps based on the characteristics and click behaviour of individual users (Hauser et al., 2009; 2014; Liberali & Ferecatu, 2022).

Box 2. From personalisation to hyperpersonalisation

The degree of personalisation varies widely, from general customer segmentation to real-time, individual interaction. As personalisation becomes increasingly data-driven, individual and context-specific, it is referred to as hyperpersonalisation (Abels et al., 2025; Cegiela et al., 2022; Mills, 2022a; Riverty, 2025). The figure below illustrates this transition. In hyperpersonalisation, insights are applied in real time and continuously adjusted based on the current behaviour and response of the individual customer. The use of (Gen)AI is essential here to make individual predictions and to automatically generate personalised offerings.

What is hyperpersonalisation?



The question is what developments in hyperpersonalisation mean for the choice environment of the future. Mills & Saetra (2024) describe the possibility of an ‘autonomous choice architect’: a system in which AI fully takes over the role of the human designer of the choice environment. These systems are driven by data and programmed to maximise a specific objective. They continuously learn from new data on user behaviour, preferences and characteristics, and dynamically adjust the choice environment based on the most up-to-date insights about the individual customer. These developments at the intersection of data science and behavioural science offer new – and previously almost unimaginable – possibilities to influence and support consumers online (Mills, 2022a; Morozovaite, 2023; Yeung, 2019).

2.3 Personalisation increases the influence of the choice environment

Personalisation can significantly enhance the influence of the choice environment on consumers. The more designers know about individual users, the more precisely they can steer behaviour and decision-making (Mills, 2022b; Narayanan et al., 2020; Porat & Strahilevitz, 2014; Susser et al., 2019). This influence may be further amplified through the use of conversational AI (Costello et al., 2024; Dellaert et al., 2020; Hackenburg et al., 2025). Conversations with AI agents align more closely with natural forms of communication than static messages and enable immediate responses with personalised counterarguments that prompt reflection. In its most advanced form, hyperpersonalisation – through continuously optimised steering – may put consumer autonomy under pressure, which raises the question of whether individuals are still able to make truly free choices (Mills & Saetra, 2024).

By tailoring the choice environment, companies can increasingly influence users’ attention and behaviour. However, this does not mean that the influence of a personalised choice environment is all-encompassing. Research suggests that the impact on behaviour is often subtle. For example, individuals with strong preferences are less susceptible to be influenced than consumers without clear preferences (De Ridder et al., 2022). Even with a highly accurate understanding of someone’s characteristics, it is unlikely that personalised steering would persuade someone who has voted ‘left’ for years to suddenly vote for a ‘right-wing’ party. A personalised choice environment has an amplified influence on behaviour, but it is not a ‘brainwashing machine’ (Matz, 2023).

3. Application in the financial sector

3.1 The first steps towards a tailored online choice environment

Personalisation of customer contact is not new in the financial sector. In direct interactions between staff and customers – for example, at a physical branch – personalisation used to be a natural part of the process. Staff could respond to non-verbal cues, ask questions, adjust their tone and make suggestions based on what they heard and observed. The digitalisation of financial services has largely replaced this personal contact, making it more difficult to adjust customer interactions based on individual needs.

The possibilities for online (hyper)personalisation are currently receiving significant attention within the financial sector (Cegiela et al., 2022; Deloitte, 2024; McKinsey, 2022, 2024). For a long time, the online choice environments of financial firms looked virtually the same for all customers. Over the last years, this situation has been changing, driven by new technologies and the increased availability of customer data. Many financial firms indicate that they are exploring how to personalise elements of the choice environment.

However, conversations with experts, software providers and financial firms – including banks, investment firms and crypto service providers – reveal that advanced personalisation is certainly not yet common practice. In reality, personalisation is often limited to minor adjustments based on broad customer segments. For example, a bank may display a banner promoting an investment account only to customers with at least €30,000 in assets. Or an investment app may vary its list of most-traded stocks depending on the country of the user.

The first steps towards more fine-grained and sophisticated forms of personalisation are mainly being taken in online advertising aimed at potential customers. Here, the tone and content of advertisements are tailored to the estimated preferences of customer segments. These segments can be defined with increasing precision and targeted more effectively, for example through social media.

Some financial firms go a step further by personalising notifications, email reminders and in-app banners. A global study by Deloitte (2024) among 349 banks found that 18% send personalised messages to customers. Among the group of banks leading the way in digital innovation, this figure was 61%. Based on available customer data – such as demographic characteristics and previous app behaviour – the message deemed most relevant at that moment is selected. These messages may support new customers during onboarding or inform existing customers about new features or additional products. In practice, a suitable message is usually selected from a predefined library of standard texts. These messages are not tailored in content or tone to the individual – meaning the level of personalisation remains limited. The timing and channel of delivery are also generally not yet personalised.

Other elements of the choice environment (beyond advertisements and messages) are rarely personalised by financial firms. In some cases, different versions of an app are available depending on account type or user experience – for example, a ‘pro version’ of a crypto app offering more advanced features. Customers may also be able to customise parts of the app themselves, such as enabling or disabling certain notifications or changing the order of accounts. Aside from such exceptions, the basic structure of the online choice environment is typically the same for all users.

Financial firms primarily use gen AI for customer service or to support internal processes. The design of the choice environment is still largely a human task. Some firms are experimenting with AI-generated content, mainly for advertisements or messages. In these cases, staff write the prompts based on insights into broader customer segments, and also decide which messages are ultimately published. Therefore, it is not yet common practice to automate entire steps in the design process.

3.2 Why (hyper)personalisation is still rarely used

Financial firms offer various explanations for the limited use of personalisation within the choice environment. A key barrier is the lack of flexibility in existing systems. Many firms, for example, are not yet able to effectively link and utilise customer data from different sources. This is partly due to internal structures often being organised around products rather than around customers (Cegiela et al., 2022).

In addition, there are clear limits to the scalability of personalisation, as it requires a large volume of diverse content. This demands significant manual effort from marketing and communication teams. Although it is technically possible to automatically generate and select personalised messages and product information, many firms report that they cannot yet fully rely on AI-generated content. Human oversight remains necessary to ensure content quality, legal compliance and brand alignment.

Personalisation of other elements – such as the structure or order of information – is technically more complex and therefore even less scalable. Many firms choose to first gain a better understanding of the impact of personalised messaging before investing in further personalisation of the choice environment. Moreover, some firms indicate that there is still considerable room to improve the general usability of the choice environment, independent of personalisation.

Beyond practical barriers, there are other reasons for the cautious approach to personalising the choice environment. Some firms perceive legal risks to be high, partly due to uncertainty around the interpretation of laws and regulations. For example, there is ambiguity about when personalisation may be considered advice: in execution-only services, there is concern that personalised elements could be interpreted as implicit advice. This uncertainty may discourage firms from applying more advanced forms of personalisation. Additionally, not all firms appear fully aware of the steering effect of design choices within the choice environment. As a result, there is less focus on personalising these elements. While the influence of advertisements and messages is often explicitly discussed, the more implicit influence of elements such as order, layout or visual presentation of information tends to receive less attention. Finally, firms may be hesitant to apply personalisation out of concern that customers will perceive it as intrusive or as a violation of their privacy. This can also make firms reluctant to request consent for the use of, for example, transaction data for personalisation purposes.

3.3 Financial firms aim to make greater use of personalisation in the future

Based on the conversations held, it appears that many financial firms intend to (further) personalise the choice environment in the future. Firms cite various benefits and point to other applications with much potential for personalisation, such as the expansion into ‘superapps’ and conversational AI.

Financial firms note that personalisation can offer direct commercial value in several ways. While some focus on personalised advertisements to attract new customers, others concentrate on personalised messages about additional products and services. Firms see advanced personalisation as a way to increase the likelihood that customers will take desired follow-up actions. For example by tailoring not only the content but also the tone of messages to the individual.

Firms also recognise the benefits of personalisation in fostering customer loyalty and encouraging active use of the app or website.

As more features and products are added to online environments, there is a risk that customers may struggle to navigate or may disengage entirely. Personalisation can be used to improve the usability of the app, for instance by reducing irrelevant messages or guiding customers to the right place at the right time. This is expected to increase the likelihood that customers will use the provider as their primary financial firm. The resulting active app usage generates data and insights that can further enhance targeted and effective personalisation. Many financial firms also believe that customers increasingly expect a personalised experience online and may be more likely to switch to a competitor if they do not receive it.

Firms also highlight the potential of personalisation to promote and support sensible financial behaviour. By estimating which actions are most appropriate for a customer's financial situation, firms can offer proactive support. Examples include personalising financial information and education, sending reminders to set money aside or providing insights into (predicted) cash flows. Other examples include support in setting and achieving savings goals, or steering customers to schedule a meeting with a financial advisor. Firms aim to improve their ability to predict which action is sensible for which customer at a given time. They expect that such initiatives will also be commercially valuable, as they may contribute to a loyal and financially healthy customer base in the long term.

From the conversations, it emerges that the potential of personalisation may be even greater for apps that evolve into 'superapps'. These apps combine multiple financial and non-financial services within a single platform (Van der Vlist et al., 2025). Superapps have so far been especially popular in China and Southeast Asia. However, financial firms operating in Europe have also expressed ambitions to integrate more services into a single app (Browne, 2025; PayPal, 2022; Revolut, 2022).

Finally, many financial firms indicate that they are focussing on further developing gen AI-based chatbots. Firms see strong potential in using conversational AI to deeply personalise customer interactions. With the rise of AI and gen AI, chatbots have become commonplace on the websites and apps of financial firms. Chatbots are expected to offer increasingly advanced functionalities and play a more prominent role within the online choice environment. Box 3 explores this development in more detail.

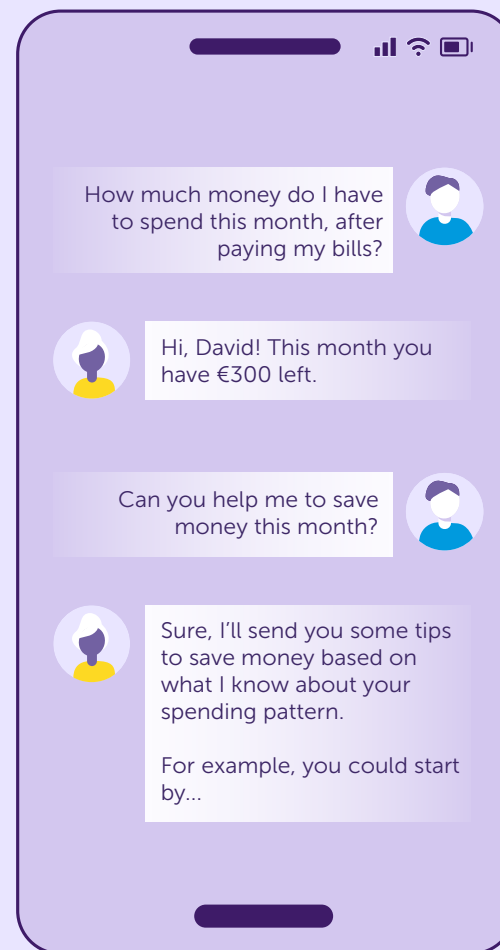
Box 3. Interacting with the choice environment: is conversational finance the future?

At present, financial firms primarily use chatbots for customer service and to provide general information. However, this functionality is rapidly evolving: customers can ask an increasing variety of questions, and some chatbots already offer personalised insights based on transaction data. Consumers are also becoming more familiar with interacting with AI assistants, partly due to applications outside the financial context, such as ChatGPT.

In the near future, financial firms are expected to experiment with broader use of chatbots as personal assistants for financial decision-making. Voice-controlled assistants (such as Alexa, Siri or Google Assistant) and video assistants also fit within this development towards conversational banking or conversational finance. Within this trend, financial firms are using gen AI to enable natural, contextual and personalised communication with customers. More advanced AI assistants are likely to play an increasingly prominent role within financial apps. When these assistants can also access real-time customer data – such as transaction history and previous interactions – their role will shift from virtual customer service to virtual financial assistant. In a global study by Accenture, 62% of surveyed consumers indicated they were open to using a financial AI assistant (Abbott et al., 2025). Developments in conversational finance may eventually result in the traditional user interface of financial apps being replaced by a new, fully personalised form of interaction.

An important open question is whether the development of conversational finance will take place within the platforms of financial firms or whether this will increasingly be embedded in conversational AI tools outside the financial sector. Crypto company Coinbase is, for example, already collaborating with the AI search engine and chatbot Perplexity. This allows users not only to view real-time market data in a dashboard, but also to ask questions about it directly. When entering this partnership, the stated ambition was that the AI chatbot would eventually be able to execute transactions and manage portfolios (Carter, 2025). Developments around universal AI agents – capable of

independently performing tasks, retaining context and offering proactive advice – may further transform how consumers receive financial information and make decisions. At the same time, this will deepen the integration between the financial sector and technology companies.



A fictional example of a conversation with a financial AI assistant.

4. Opportunities and risks

4.1 Personalisation offers opportunities to support consumers in making financial decisions

A personalised choice environment can support consumers in making sensible financial decisions. When the tone and visual presentation of information align with individual preferences and needs, consumers are more likely to receive the information they require. Examples include the use of plain language, infographics or interactive elements tailored to the user's level of knowledge, preferences and context. An investment app might display interactive charts more prominently for customers who have previously engaged with visual elements. A pension provider could use gen AI to generate messages that best match specific (groups of) pension participants.

Better alignment of available options and information with individual consumers can also help reduce *choice overload* and *information overload*. Personalising the order or categorisation of available options makes it more likely that consumers will find what they need – or discover what may be relevant to them – without feeling overwhelmed (Dellaert et al., 2024; Hutmacher & Appel, 2023; Johnson, 2021; Sunstein, 2024). The added value for consumers seems greatest in situations where they have to navigate a broad or complex product offering. It is possible to adapt the structure and layout of an app based on customer data, making it easier for customers to find what they are looking for or need. For example, if a customer does not yet have a savings buffer, the bank could adjust the app layout to make it easy to set up an automatic savings instruction. Alternatively, customers who already save and have a substantial buffer could be guided more easily towards suitable investment opportunities.

A personalised choice environment can also help consumers by drawing attention to relevant considerations at times that matter. Well-timed reminders, alerts and suggestions can support consumers by highlighting crucial decisions and risks. A good example of this was shown in a field experiment in which personalized alerts were sent when customers were at risk of overdraft. These alerts led to a reduction in overdraft fees (Ben-David et al., 2025). Personalisation can also contribute to financially healthy behaviour. For instance by offering personalised support in achieving savings goals, providing insights into spending patterns or highlighting rising or duplicate expenses. Through personalised gamification and tailored education, financial firms can encourage healthy financial behaviour and help customers understand the consequences of their choices. The rise of conversational AI also makes it possible to support customers in an accessible way – by means of a virtual financial coach. There are already apps that provide users with conversational support in managing their money.

4.2 Personalisation may have undesirable consequences for consumers

Personalisation of the online choice environment does not automatically lead to better outcomes for consumers; it may amplify existing risks of adverse influence. Financial firms pursue commercial objectives – such as product sales or active app usage. Ideally, these objectives do not conflict with the customer's best interest. In practice, however, such conflicts occur regularly. Systems for (automated) personalisation can increase this tension. They optimise on the basis of data and algorithms and are increasingly capable of responding to individual sensitivities (Helberger et al., 2022; Susser et al., 2019). In this way, personalisation may increase the existing risk of adverse influence of the choice environment – such as previously observed steering in cryptoapps towards active app usage or trading (AFM, 2024b). Think of apps that might trigger certain behaviours by exploiting a person's vulnerabilities or emotional state.

Advanced personalisation makes all consumers potentially vulnerable. The availability of large volumes of individual data and continuously learning models makes it possible to determine how and when someone can best be influenced. In the case of advanced personalisation, vulnerability is no longer limited to group characteristics, such as young people or individuals in debt (Zac et al., 2023). Advanced personalisation can make any consumer vulnerable, as it enables the creation of an individual ‘persuasion profile’ – which may even vary depending on context and timing (Busch & Fletcher, 2024; Helberger et al., 2022).

Even when financial firms use personalisation with the intention of helping customers, unintended side effects may occur. For example, firms may overlook considerations that fall outside the learning scope of the algorithm – such as the long-term impact on consumers’ broader financial wellbeing (Stray et al., 2024). Moreover, systems that primarily recommend variations based on previously observed behaviour may reinforce (prior) unwise choices and limit exposure to alternative options (Izyumenko & Senftleben, 2025). Consider an investment app that repeatedly highlights products similar to those previously purchased, potentially resulting in a poorly diversified portfolio. A similar issue may arise with conversational AI. Because the options and information shown depend on the prompts entered by the user, consumers often receive suggestions that align with their existing preferences – while unfamiliar or alternative possibilities remain out of view.

Poor-quality algorithms and data can also lead to suboptimal outcomes for consumers – or even to discrimination. For instance, savings or investment opportunities may be shown less prominently to customers living in postcode areas with lower average incomes. This may make them less inclined to accumulate wealth. In a previous publication on the impact of AI on the financial sector, the AFM and DNB also highlighted these and other risks related to algorithm use (DNB, 2024).

Box 4. What do consumers think about personalisation and the use of their data?

Personalisation can evoke both positive and negative reactions among consumers. People increasingly expect online environments to be user-friendly, intuitive and easy to navigate. These expectations may be even higher among digitally native generations, such as Generation Z (AFM, 2025c). Personalisation offers opportunities to meet these expectations. At the same time, it raises important questions around acceptance, privacy, transparency and control. Research shows that people often accept personalised services, but are more negative about the collection of personal data required to enable them (Halsworth, 2023; Kozyreva et al., 2021). This tension reflects what is known as the ‘personalisation paradox’: personalisation leads to positive reactions due to increased relevance or ease of use, but also raises concerns about privacy and control (Aguirre et al., 2015; Sutanto et al., 2013). Negative reactions may arise when consumers perceive detailed or unexpected personalisation as a form of surveillance, a breach of privacy or an attempt at manipulation (BIT, 2023; Nobile & Cantoni, 2023).

Although people often state that privacy is important to them, their online behaviour does not always reflect this (Kokolakis, 2017). The collection and use of customer data by companies for personalisation purposes typically requires, among other things, explicit consumer consent. In practice, consumers often accept cookies or terms and conditions routinely. It is often difficult for consumers to understand what they are agreeing to and what the implications are (Matz, 2025). Time constraints, cognitive load and ‘privacy fatigue’ – caused by frequent consent requests – make it hard to make informed decisions (Choi et al., 2018). Moreover, the way consent is requested (or can be withdrawn) is often unclear or not user-friendly (Kozyreva et al., 2021; Utz et al., 2019). Examples include vague language, misleading buttons or hiding information in general terms and conditions.

Personalisation also raises questions about transparency. It is difficult for consumers to determine when personalisation is taking place and what it is based on. The personalised choice environment effectively forms an invisible layer between the user and the choice (Busch & Fletcher, 2024). For example, consumers typically have no idea which advertisements or choice environments other users are seeing. This lack of awareness may make people more susceptible to influence (Strycharz & Duivenvoorde, 2021). And even when consent has been given and it is clear that personalisation is occurring, it may still be unclear – especially in the case of automated personalisation – which data and logic underpin the choices presented.

5. Responsible application

5.1 Careful and responsible application by financial firms

The AFM encourages financial firms to explore how personalisation can be used to promote sensible financial decisions. It is important to handle these new possibilities in a careful and responsible manner.

Naturally, firms must comply with applicable laws and regulations when applying personalisation within the choice environment. Box 5 provides a brief, non-exhaustive overview of potentially relevant legislation.

It is the responsibility of financial firms to carefully assess the application of personalisation in the choice environment and to refrain from using it when it does not serve the customer's best interest. Responsible implementation of personalisation begins by defining the objectives pursued. For what purpose will the choice environment be optimised? And to what extent will this contribute to sensible financial decision-making? The commercial interests of the firm should not take precedence over the customer's interest.

In addition, active monitoring of the influence of personalisation on (outcomes for) consumers is crucial. Personalisation can make all consumers more vulnerable to undesirable influence. Firms should pay special attention to unintended side effects when applying personalisation, such as negative effects on outcomes that fall outside the scope of the algorithm, the reinforcement of (prior) unwise choices and the risk of discrimination.

We note that firms are rightly cautious about the automated use of gen AI in designing the choice environment. This allows firms to maintain control over content quality and limit legal risks. Also, the broader use of conversational AI requires increased vigilance due to the fully automated nature of customer interactions and the potentially stronger influence it has on consumer behaviour.

Responsible implementation also requires that consumers have meaningful control over personalisation within the choice environment (Hutmacher & Appel, 2023). This goes beyond the current, often unclear and user-unfriendly design of informed consent. Meaningful control means that consumers should be able to decide – at any time and for each application – whether they want a personalised choice environment, supported by accessible settings and clear explanations. This ensures that consumers can always revert to a fully non-personalised environment and assess whether personalisation offers personal benefits.

Box 5. Legal and regulatory framework

When personalising the choice environment, different legal frameworks may apply depending on the type of financial firm. It is the responsibility of the financial firm to be aware of and comply with the applicable laws and regulations. Below is a brief, non-exhaustive overview of potentially relevant legislation and regulation.

1. Duty of care and customer interest

The Dutch Financial Supervision Act (Wft) and related regulations contain duty-of-care provisions that financial firms must comply with. The purpose of these duties is to protect consumer interests. Financial firms must remain mindful of these interests and act with care, even when applying personalisation. Sector-specific legislation often includes its own duty-of-care requirements. For example, under MiCAR, crypto service providers are required to act in accordance with the interests of their existing or potential clients.

2. Information provision and advice

Information within a personalised choice environment must meet the legal requirements for information disclosure. For example, it must be correct, clear and not misleading (AFM, 2024c). When personalising the choice environment, it is important to consider the boundary between providing information and giving advice (AFM, 2021b). Advice occurs when a specific recommendation is made about a financial product that is tailored to the customer's personal situation. For example, investment firms may be deemed to provide advice if the online environment implies that a financial instrument is suitable for a particular investor – such as by sending a message about instruments purchased by investors with similar characteristics and needs (ESMA, 2023). In cases of advice, firms must comply with the relevant legal requirements, including rules on gathering customer information in advance, commission standards and advisor competence requirements.

3. Product governance and the choice environment

Legal requirements for the product development process ('product governance', AFM, n.d.-b) may have implications for personalising the choice environment. Adequate product governance means, among other things, that financial firms ensure products are distributed to the intended target group and not (systematically) beyond it. Product information and distribution must also be aligned with the target group, as far as can reasonably be expected. In addition to product governance requirements, various European legal standards aim to protect consumers from harmful online choice architecture and dark patterns, including the revised DMFSD Directive, which will come into force in mid-2026 (Busch & Fletcher, 2024).

4. Choice guidance in pension decisions

Since 1 July 2023, the choice guidance standard requires pension providers to enable participants to make appropriate choices. Understanding the needs, characteristics and capabilities of (groups of) pension participants forms the basis for effective choice guidance. Pension providers may decide to segment or personalise elements of the choice environment based on these insights (AFM, n.d.-a).

5. Use of data and algorithms

Data and algorithms are typically the foundation for personalising the online choice environment. All firms that process personal data must comply with the GDPR. Oversight of the GDPR lies primarily with the Dutch Data Protection Authority (Autoriteit Persoonsgegevens). The European AI Act includes a ban on manipulative, misleading and exploitative AI systems (Autoriteit Persoonsgegevens, 2024a). To prevent discrimination, the AI Act also prohibits certain systems that assess or classify individuals based on behaviour or personal characteristics (Autoriteit Persoonsgegevens, 2024b). When using algorithms, it is important that firms document or can reconstruct how choices were made in the customer's interest, for example in the case of conversational AI.

5.2 Implications for supervision

It is crucial that supervision responds in a timely manner to technological developments related to the personalisation of the choice environment, including conversational AI. These developments raise questions about the alignment of current laws and regulations and the supervision of the rapidly changing choice environment. Although, much legislation is technology-neutral, uncertainty about existing regulations may slow down innovation. This could lead to missed opportunities to support consumers in making sensible financial decisions.

The AFM considers it important that financial firms have clarity on when personalisation falls within the scope of financial advice. The trend towards personalising the choice environment creates new possibilities that sometimes lie near the legal boundary between information provision and advice. Examples include automatically highlighting certain products or product features for an individual customer or sending personalised messages about specific products. Some financial firms experience uncertainty about when personalisation of the choice environment classifies as financial advice. As a result, they may be hesitant to use personalisation. The AFM will further explore such uncertainties and take action where necessary. In this context, we are also following with interest the recent efforts by the Financial Conduct Authority in the United Kingdom to provide more clarity on the boundary between information and advice (FCA, 2025). We invite financial firms to share any concerns they may have on this topic with the AFM.

In the coming years, our focus will be on accessible and targeted support for consumers in making financial decisions. Developments in personalisation offer opportunities to guide consumers in an accessible manner towards sensible financial choices. The AFM sees significant potential for such support, also when firms do not make recommendations about specific financial products. Examples include providing insight into the personal financial situation or highlighting relevant and potentially sensible choices – such as supplementary pension saving for the self-employed or options for

making homes more sustainable for homeowners. Moreover, the choice environment can be tailored at segment level to emphasise important considerations, for example when weighing saving against investing. The AFM is committed to accessible and targeted support for consumers in making financial decisions, with attention to the opportunities that personalisation offers.

Finally, the possibilities for personalisation of the choice environment raise new questions about the way in which the AFM conducts its supervision. Through this and previous exploratory studies, we are building our knowledge of the opportunities and risks associated with digitalisation, AI and personalisation (AFM, 2024b; 2025b). Personalisation increases the volume of content under our supervision, while its visibility decreases. We will therefore examine how we can maintain adequate oversight and supervision of increasingly personalised online choice environments and their influence on consumers. It is also important to monitor developments among foreign firms that are not under AFM supervision but do serve Dutch consumers. Finally, as conversational AI is expected to play an increasingly prominent role in choice environments, this technology warrants additional attention in the coming years.

6. References

- Abels, C. M., Lopez-Lopez, E., Burton, J. W., Holford, D. L., Brinkmann, L., Herzog, S. M., & Lewandowsky, S. (2025). The governance & behavioral challenges of generative artificial intelligence's hypercustomization capabilities. *Behavioral Science & Policy*, 11(1), 22-32.
- Abbott, M., Oon, K. K., Centonze, M. & Coppolecchia, A. (2025). *Banking Consumer Study 2025: Where Is the Love?* Accenture. <https://www.accenture.com/content/dam/accenture/final/industry/banking/document/Accenture-Global-Banking-Consumer-Study-2025-Report.pdf>
- Alves Gomes, M., & Meisen, T. (2023). A review on customer segmentation methods for personalized customer targeting in e-commerce use cases. *Information Systems and e-Business Management*, 21(3), 527-570.
- Autoriteit Persoonsgegevens (2024a, 18 december). *Reacties en vervolgstappen oproep: verbod op manipulatie, misleidende en uitbuitende AI-systemen*. <https://www.autoriteitpersoonsgegevens.nl/documenten/reacties-en-vervolgstappen-oproep-verbod-op-manipulatie-misleidende-en-uitbuitende-ai-systemen>
- Autoriteit Persoonsgegevens (2024b, 18 december). *Oproep tot input: verbod op AI-systemen voor social scoring*. <https://www.autoriteitpersoonsgegevens.nl/documenten/oproep-tot-input-verbod-op-ai-systemen-voor-social-scoring>
- Autoriteit Persoonsgegevens (2025, 15 juli). *AP: Emoties herkennen met AI 'dubieus en risicovol'*. <https://www.autoriteitpersoonsgegevens.nl/actueel/ap-emoties-herkennen-met-ai-dubieus-en-risicovol>
- Ascarza, E., Neslin, S. A., Netzer, O., Anderson, Z., Fader, P. S., Gupta, S., ... & Schrift, R. (2018). In pursuit of enhanced customer retention management: Review, key issues, and future directions. *Customer Needs and Solutions*, 5(1), 65-81.
- AFM (2021a, 30 maart). *AFM: gebruik gedragsinzichten om verstandige financiële keuzes te bevorderen*. <https://www.afm.nl/nl-nl/sector/actueel/2021/mrt/principes-consumentengedragsinzichten>
- AFM (2021b, 15 december). *Interpretatie informeren en adviseren*. <https://www.afm.nl/~profmedia/files/nieuws/2021/interpretatie-informeren-en-adviseren.pdf>
- AFM (2023a, 16 februari). *Bewustere inrichting online beleggingsplatforms noodzakelijk*. <https://www.afm.nl/nl-nl/sector/actueel/2023/februari/bewustere-inrichting-online-beleggingsplatform>
- AFM (2023b, 3 maart). *HERs passen machine learning op grote schaal toe in handelsalgoritmes*. <https://www.afm.nl/nl-nl/sector/actueel/2023/maart/her-machine-learning>
- AFM (2024a, 9 april). *Cryptoapps zijn nog niet ingericht in het belang van de klant*. <https://www.afm.nl/nl-nl/sector/actueel/2024/april/cryptodienstverleners>
- AFM (2024b, 11 april). *Kansen en risico's van digitalisering verzekeringsmarkt de komende 10 jaar*. <https://www.afm.nl/nl-nl/sector/actueel/2023/april/kansen-risico-digitalisering-verzekeringsmarkt>
- AFM (2024c, 30 september). *Herziening Beleidsregel Informatieverstrekking*. <https://www.afm.nl/nl-nl/sector/actueel/2024/september/herziening-beleidsregel-informatieverstrekking>
- AFM (2025a, 8 april). *Oproep aan verzekeraars: geef loyale klanten een eerlijke premie*. <https://www.afm.nl/nl-nl/sector/actueel/2025/apr/sb-margepersonalisatie>
- AFM (2025b, 2 juni). *Kansen en risico's van digitalisering kredietverleningsmarkt 2035*. <https://www.afm.nl/nl-nl/sector/actueel/2025/jun/sb-tech2035>
- AFM (2025c, 3 juni). *AFM wil dialoog stimuleren om Gen Z te ondersteunen op financiële markten*. <https://www.afm.nl/en/sector/actueel/2025/jun/pb-genz>
- AFM (z.d.-a). *Keuzebegeleiding*. <https://www.afm.nl/nl-nl/sector/pensioenuitvoerders/informeren-deelnemers/keuzebegeleiding>
- AFM (z.d.-b). *Productontwikkeling en -distributie*. <https://www.afm.nl/nl-nl/sector/themas/dienstverlening-aan-consumenten/informatieverstrekking/productontwikkeling-en--distributie>

- Aguirre, E., Mahr, D., Grewal, D., De Ruyter, K., & Wetzels, M. (2015). Unraveling the personalization paradox: The effect of information collection and trust-building strategies on online advertisement effectiveness. *Journal of Retailing*, 91(1), 34-49.
- Azucar, D., Marengo, D., & Settanni, M. (2018). Predicting the Big 5 personality traits from digital footprints on social media: A meta-analysis. *Personality and Individual Differences*, 124, 150-159.
- Ben-David, D., Mintz, I., & Sade, O. (2025). Using AI and behavioral finance to cope with limited attention and reduce overdraft fees. *Management Science*. Advance online publication. <https://doi.org/10.1287/mnsc.2022.00304>
- Bennani, S., Maalel, A., & Ben Ghezala, H. (2022). Adaptive gamification in E-learning: A literature review and future challenges. *Computer Applications in Engineering Education*, 30(2), 628-642.
- Blömker, J., & Albrecht, C. M. (2023). A path from multichannel customer data to real-time personalization: Predicting customers' psychological traits through machine learning. *Journal of Retailing and Consumer Services*, 87, 104349.
- Browne, R. (2025, 18 juni). *Klarna CEO outlines plan to become super app with AI*. CNBC. <https://www.cnn.com/2025/06/18/klarna-ceo-outlines-plan-to-become-super-app-with-ai.html>
- Busch, C., & Fletcher, A. (2024, 29 mei). *Harmful Online Choice Architecture*. <https://cerre.eu/publications/harmful-online-choice-architecture/>
- Carter, S. (2025, 11 juli). *Perplexity AI teams with Coinbase teams to boost crypto intelligence*. Forbes. <https://www.forbes.com/sites/digital-assets/2025/07/11/perplexity-ai-teams-with-coinbase-teams-to-boost-crypto-intelligence/>
- Cegiela, Strauss, Strzelczyk, Widowitz, & Panowicz (2022, oktober). *Just For You: The Route to Hyper-personalization in Banking*. <https://media-publications.bcg.com/Just-For-You-The-Route-to-Hyper-personalization-in-Banking.pdf>
- Chaudhuri, N., Gupta, G., Vamsi, V., & Bose, I. (2021). On the platform but will they buy? Predicting customers' purchase behavior using deep learning. *Decision Support Systems*, 149, 113622.
- Choi, H., Park, J., & Jung, Y. (2018). The role of privacy fatigue in online privacy behavior. *Computers in Human Behavior*, 81, 42-51.
- Costello, T. H., Pennycook, G., & Rand, D. G. (2024). Durably reducing conspiracy beliefs through dialogues with AI. *Science*, 385(6714).
- Dellaert, B. G., Johnson, E. J., Duncan, S., & Baker, T. (2024). Choice architecture for healthier insurance decisions: Ordering and partitioning together can improve consumer choice. *Journal of Marketing*, 88(1), 15-30.
- Dellaert, B. G., Shu, S. B., Arentze, T. A., Baker, T., Diehl, K., Donkers, B., ... & Steffel, M. (2020). Consumer decisions with artificially intelligent voice assistants. *Marketing Letters*, 31(4), 335-347.
- Deloitte (2024). *Digital Banking Maturity 2024*. <https://www.deloitte.com/nl/en/Industries/financial-services/research/digital-banking-maturity-2024.html>
- De Ridder, D., Kroese, F., & van Gestel, L. (2022). Nudgeability: Mapping conditions of susceptibility to nudge influence. *Perspectives on Psychological Science*, 17(2), 346-359.
- DNB (2024, 9 april). *AFM en DNB publiceren rapport over de impact van AI in de financiële sector en het toezicht daarop*. <https://www.dnb.nl/nieuws-voor-de-sector/toezicht-2024/afm-en-dnb-publiceren-rapport-over-de-impact-van-ai-in-de-financiele-sector-en-het-toezicht-daarop/>
- ESMA (2023). *Supervisory briefing on understanding the definition of advice under MiFID II*. https://www.esma.europa.eu/sites/default/files/2023-07/ESMA35-43-3861_Supervisory_briefing_on_understanding_the_definition_of_advice_under_MiFID_II.pdf
- Farahat, A., & Bailey, M. C. (2012, April). How effective is targeted advertising?. In *Proceedings of the 21st international conference on World Wide Web* (pp. 111-120).
- FCA (2025, 30 juni). *CP25/17: Supporting consumers' pensions and investment decisions: proposals for targeted support*. <https://www.fca.org.uk/publications/consultation-papers/cp25-17-supporting-consumers-pensions-investment-decisions>
- Fisher, M., & Oppenheimer, D. M. (2025). When a nudge becomes invisible: How behavioral interventions prompt metacognitive miscalibration. *International Journal of Research in Marketing*, in press.

- Gao, Y., & Liu, H. (2022). Artificial intelligence-enabled personalization in interactive marketing: a customer journey perspective. *Journal of Research in Interactive Marketing*, 17(5), 663-680.
- Gladstone, J. J., Matz, S. C., & Lemaire, A. (2019). Can Psychological Traits Be Inferred From Spending? Evidence From Transaction Data. *Psychological Science*, 30(7), 1087-1096.
- Guenzel, M., Kogan, S., Niessner, M., & Shue, K. (2025, 9 januari). *AI personality extraction from faces: Labor market implications* [Working paper]. SSRN. <https://doi.org/10.2139/ssrn.5089827>
- Hackenburg, K., & Margetts, H. (2024a). Evaluating the persuasive influence of political microtargeting with large language models. *Proceedings of the National Academy of Sciences*, 121(24), e2403116121.
- Hackenburg, K., & Margetts, H. (2024b). Reply to Teeny and Matz: Toward the robust measurement of personalized persuasion with generative AI. *Proceedings of the National Academy of Sciences*, 121(43), e2418817121.
- Hackenburg, K., Tappin, B. M., Hewitt, L., Saunders, E., Black, S., Lin, H., ... & Summerfield, C. (2025). The Levers of Political Persuasion with Conversational AI. *arXiv preprint arXiv:2507.13919*.
- Haleem, A., Javaid, M., Qadri, M. A., Singh, R. P., & Suman, R. (2022). Artificial intelligence (AI) applications for marketing: A literature-based study. *International Journal of Intelligent Networks*, 3, 119-132.
- Halsworth, M. (2023, 20 maart). *A Manifesto for Applying Behavioral Science*. The Behavioural Insights Team. <https://www.bi.team/publications/a-manifesto-for-applying-behavioral-science/>
- Hauser, J. R., Liberali, G., & Urban, G. L. (2014). Website morphing 2.0: Switching costs, partial exposure, random exit, and when to morph. *Management Science*, 60(6), 1594-1616.
- Hauser, J. R., Urban, G. L., Liberali, G., & Braun, M. (2009). Website morphing. *Marketing Science*, 28(2), 202-223.
- Helberger, N., Sax, M., Strycharz, J., & Micklitz, H. W. (2022). Choice architectures in the digital economy: Towards a new understanding of digital vulnerability. *Journal of Consumer Policy*, 45(2), 175-200.
- Hirsh, J. B., Kang, S. K., & Bodenhausen, G. V. (2012). Personalized persuasion: Tailoring persuasive appeals to recipients' personality traits. *Psychological Science*, 23(6), 578-581.
- Hu, W., & Shao, Z. (2025). Design and Evaluation of a GenAI-Based personalized Educational Content System Tailored to Personality Traits and Emotional Responses for Adaptive Learning. *Computers in Human Behavior Reports*, 19, 100735.
- Hutmacher, F., & Appel, M. (2023). The psychology of personalization in digital environments: From motivation to well-being—a theoretical integration. *Review of General Psychology*, 27(1), 26-40.
- Izyumenko, E., & Senftleben, M. (2025). Online Behavioural Advertising, Consumer Empowerment and Fair Competition: Are the DSA Transparency Obligations the Right Answer? *Journal of European Consumer and Market Law*, 14(2), 46-59.
- Johnson, E. J. (2021). *The elements of choice: Why the way we decide matters*. Penguin.
- Joyal-Desmarais, K., Scharmer, A. K., Madzelan, M. K., See, J. V., Rothman, A. J., & Snyder, M. (2022). Appealing to motivation to change attitudes, intentions, and behavior: A systematic review and meta-analysis of 702 experimental tests of the effects of motivational message matching on persuasion. *Psychological Bulletin*, 148(7-8), 465.
- Kapoor, A., & Kumar, M. (2025). Frontiers: Generative AI and personalized video advertisements. *Marketing Science*, 44(4), 733-973.
- Kokolakis, S. (2017). Privacy attitudes and privacy behaviour: A review of current research on the privacy paradox phenomenon. *Computers & Security*, 64, 122-134.
- Kosinski, M. (2021). Facial recognition technology can expose political orientation from naturalistic facial images. *Scientific Reports*, 11(1), 100.
- Kozyreva, A., Lorenz-Spreen, P., Hertwig, R., Lewandowsky, S., & Herzog, S. M. (2021). Public attitudes towards algorithmic personalization and use of personal data online: Evidence from Germany, Great Britain, and the United States. *Humanities and Social Sciences Communications*, 8(1), 1-11.
- Lemmens, A., Roos, J. M., Gabel, S., Ascarza, E., Bruno, H., Gordon, B. R., ... & Netzer, O. (2025). Advancing Personalization: How to Experiment, Learn, & Optimize. *International Journal of Research Marketing*, in press.

- Liberali, G., & Ferecatu, A. (2022). Morphing for consumer dynamics: Bandits meet hidden Markov models. *Marketing Science*, 41(4), 769-794.
- LiKamWa, R., Liu, Y., Lane, N. D., & Zhong, L. (2013, juni). Moodscope: Building a mood sensor from smartphone usage patterns. In *Proceeding of the 11th annual international conference on Mobile systems, applications, and services* (pp. 389-402).
- Long, X., Sun, J., Dai, H., Zhang, D., Zhang, J., Chen, Y., ... & Zhao, B. (2025). The choice overload effect in online recommender systems. *Manufacturing & Service Operations Management*, 27(1), 249-268.
- Marengo, D., & Montag, C. (2020). Digital phenotyping of big five personality via Facebook data mining: a meta-analysis. *Digital Psychology*, 1(1), 52-64.
- Matz, S. (2023, maart-april). What psychological targeting can do. *Harvard Business Review*. <https://hbr.org/2023/03/what-psychological-targeting-can-do>
- Matz, S. C. (2025). *Mindmasters: The data-driven science of predicting and changing human behavior*. Harvard Business Review Press.
- Matz, S. C., Kosinski, M., Nave, G., & Stillwell, D. J. (2017). Psychological targeting as an effective approach to digital mass persuasion. *Proceedings of the National Academy of Sciences*, 114(48), 12714-12719.
- Matz, S. C., Menges, J. I., Stillwell, D. J., & Schwartz, H. A. (2019). Predicting individual-level income from Facebook profiles. *PloS one*, 14(3), e0214369.Z
- Matz, S. C., & Netzer, O. (2017). Using big data as a window into consumers' psychology. *Current Opinion in Behavioral Sciences*, 18, 7-12.
- Matz, S. C., Teeny, J. D., Vaid, S. S., Peters, H., Harari, G. M., & Cerf, M. (2024). The potential of generative AI for personalized persuasion at scale. *Scientific Reports*, 14(1), 4692.
- McKinsey (2022, 29 november). *Building a winning AI neobank*. <https://www.mckinsey.com/industries/financial-services/our-insights/building-a-winning-ai-neobank>
- McKinsey (2024, 9 december). Extracting value from AI in banking: rewiring the enterprise. <https://www.mckinsey.com/industries/financial-services/our-insights/extracting-value-from-ai-in-banking-rewiring-the-enterprise>
- Mills, S. (2022a). Finding the 'nudge' in hypernudge. *Technology in Society*, 71, 102117.
- Mills, S. (2022b). Personalized nudging. *Behavioural Public Policy*, 6(1), 150-159.
- Mills, S., & Sætra, H. S. (2024). The autonomous choice architect. *AI & Society*, 39(2), 583-595.
- Morozovaite, V. (2023). Hypernudging in the changing European regulatory landscape for digital markets. *Policy & Internet*, 15(1), 78-99.
- Münscher, R., Vetter, M., & Scheuerle, T. (2016). A review and taxonomy of choice architecture techniques. *Journal of Behavioral Decision Making*, 29(5), 511-524.
- Narayanan, A., Mathur, A., Chetty, M., & Kshirsagar, M. (2020). Dark Patterns: Past, Present, and Future: The evolution of tricky user interfaces. *Queue*, 18(2), 67-92.
- Netflix Technology Blog. (2017, 7 december). *Artwork personalization at Netflix*. <https://netflixtechblog.com/artwork-personalization-at-netflix-c589f074ad76/>
- Nobile, T. H., & Cantoni, L. (2023). Personalisation (In)effectiveness in email marketing. *Digital Business*, 3(2), 100058.
- Nunes, I., & Jannach, D. (2017). A systematic review and taxonomy of explanations in decision support and recommender systems. *User Modeling and User-Adapted Interaction*, 27(3), 393-444.
- Olayinka, O. H. (2021). Data driven customer segmentation and personalization strategies in modern business intelligence frameworks. *World Journal of Advanced Research and Reviews*, 12(3), 711-726.
- Orji, R., Tondello, G. F., & Nacke, L. E. (2018). Personalizing persuasive strategies in gameful systems to gamification user types. In *Proceedings of the 2018 CHI conference on human factors in computing systems* (pp. 1-14).
- Palomares, I., Porcel, C., Pizzato, L., Guy, I., & Herrera-Viedma, E. (2021). Reciprocal Recommender Systems: Analysis of state-of-art literature, challenges and opportunities towards social recommendation. *Information Fusion*, 69, 103-127.

- PayPal (2022, July 14). *The evolution of super apps*. <https://www.paypal.com/uk/brc/article/enterprise-evolution-of-super-apps>
- Peer, E., & Mills, S. (2025, 8 juli). From One, Many: How to Personalise Nudges? https://doi.org/10.31234/osf.io/b7fd9_v2
- Peters, H., Cerf, M., & Matz, S. (2024a, 20 mei). *Large language models can infer personality from free-form user interactions* [Preprint]. OSF. <https://doi.org/10.31219/osf.io/apc5g>
- Peters, H., Liu, Y., Barbieri, F., Baten, R. A., Matz, S. C., & Bos, M. W. (2024b). Context-aware prediction of active and passive user engagement: Evidence from a large online social platform. *Journal of Big Data*, 11(1), 110.
- Porat, A., & Strahilevitz, L. J. (2014). Personalizing default rules and disclosure with big data. *Michigan Law Review*, 112(8), 1417.
- Ramon, Y., Farrokhnia, R. A., Matz, S. C., & Martens, D. (2021). Explainable AI for psychological profiling from behavioral data: An application to big five personality predictions from financial transaction records. *Information*, 12(12), 518.
- Raza, S., Rahman, M., Kamawal, S., Toroghi, A., Raval, A., Navah, F., & Kazemeini, A. (2024). A comprehensive review of recommender systems: Transitioning from theory to practice. *arXiv preprint arXiv:2407.13699*.
- Revolut (2022, 2 november). *Revolut launches Revolut Chat, an instant messaging feature in step forward to super app*. https://www.revolut.com/news/revolut_launches_revolut_chat_an_instant_messaging_feature_in_step_forward_to_super_app/
- Rivery. (2025, 14 mei). *How AI in fintech is powering hyper-personalized finance*. Rivery Insights: Fintech 2040. <https://www.rivery.com/en/business/insights/fintech-2040/how-ai-in-fintech-is-powering-hyper-personalized-finance/>
- Rodrigues, L., Palomino, P. T., Toda, A. M., Klock, A. C., Oliveira, W., Avila-Santos, A. P., ... & Isotani, S. (2021). Personalization improves gamification: Evidence from a mixed-methods study. *Proceedings of the ACM on Human-Computer Interaction*, 5(287), 1-25.
- Roy, D., & Dutta, M. (2022). A systematic review and research perspective on recommender systems. *Journal of Big Data*, 9(1), 59.
- Salvi, F., Horta Ribeiro, M., Gallotti, R., & West, R. (2025). On the conversational persuasiveness of GPT-4. *Nature Human Behaviour*, 9, 1645-1653.
- Simchon, A., Edwards, M., & Lewandowsky, S. (2024). The persuasive effects of political microtargeting in the age of generative artificial intelligence. *PNAS Nexus*, 3(2), pgae035.
- Stachl, C., Au, Q., Schoedel, R., Gosling, S. D., Harari, G. M., Buschek, D., ... & Bühner, M. (2020). Predicting personality from patterns of behavior collected with smartphones. *Proceedings of the National Academy of Sciences*, 117(30), 17680-17687.
- Strycharz, J., & Duivenvoorde, B. B. (2021). The exploitation of vulnerability through personalised marketing communication: are consumers protected?. *Internet Policy Review*, 10(4), 1-27.
- Sunstein, C. R. (2024). Choice engines and paternalistic AI. *Humanities and Social Sciences Communications*, 11(1), 1-4.
- Susser, D. (2019, januari). Invisible influence: Artificial intelligence and the ethics of adaptive choice architectures. In *Proceedings of the 2019 AAAI/ACM Conference on AI, Ethics, and Society* (pp. 403-408).
- Susser, D., Roessler, B., & Nissenbaum, H. (2019). Online manipulation: Hidden influences in a digital world. *Georgetown Law Technology Review*, 4, 1.
- Sutanto, J., Palme, E., Tan, C. H., & Phang, C. W. (2013). Addressing the personalization-privacy paradox: An empirical assessment from a field experiment on smartphone users. *MIS Quarterly*, 37(4), 1141-1164.
- Teeny, J. D., & Matz, S. C. (2024). We need to understand “When” not “If” generative AI can enhance personalized persuasion. *Proceedings of the National Academy of Sciences*, 121(43), e2418005121.
- Teeny, J. D., Siev, J. J., Briñol, P., & Petty, R. E. (2021). A review and conceptual framework for understanding personalized matching effects in persuasion. *Journal of Consumer Psychology*, 31(2), 382-414.
- Tondello, G. F., Mora, A., & Nacke, L. E. (2017). Elements of gameful design emerging from user preferences. In *Proceedings of the annual symposium on computer-human interaction in play* (pp. 129-142).
- Tovanich, N., Centellegher, S., Seghouani, N. B., Gladstone, J., Matz, S., & Lepri, B. (2021). Inferring psychological traits from spending categories and dynamic consumption patterns. *EPJ Data Science*, 10(1), 24.

- Utz, C., Degeling, M., Fahl, S., Schaub, F., & Holz, T. (2019, november). (Un)informed consent: Studying GDPR consent notices in the field. In *Proceedings of the 2019 ACM Sigsac conference on computer and communications security* (pp. 973-990).
- Van der Vlist, F. N., Helmond, A., Dieter, M., & Weltevrede, E. (2025). Super-appification: Conglomeration in the global digital economy. *New Media & Society*, 27(6), 3314-3337.
- Villanova, D., Bodapati, A. V., Puccinelli, N. M., Tsiros, M., Goodstein, R. C., Kushwaha, T., ... & Hatfield, C. (2021). Retailer marketing communications in the digital age: getting the right message to the right shopper at the right time. *Journal of Retailing*, 97(1), 116-132.
- Wang, Y., & Kosinski, M. (2018). Deep neural networks are more accurate than humans at detecting sexual orientation from facial images. *Journal of personality and social psychology*, 114(2), 246–257.
- Wasilewski, A., & Kolaczek, G. (2024). One size does not fit all: Multivariant user interface personalization in e-commerce. *IEEE Access*, 12, 65570-65582.
- Yeung, K. (2019). 'Hypernudge': Big Data as a mode of regulation by design. In *The social power of algorithms* (pp. 118-136). Routledge.
- Zac, A., Huang, Y. C., von Moltke, A., Decker, C., & Ezrachi, A. (2023). Dark patterns and consumer vulnerability. *Behavioural Public Policy*, 1-50.
- Zarouali, B., Dobber, T., De Pauw, G., & De Vreese, C. (2022). Using a personality-profiling algorithm to investigate political microtargeting: Assessing the persuasion effects of personality-tailored ads on social media. *Communication Research*, 49(8), 1066-1091.