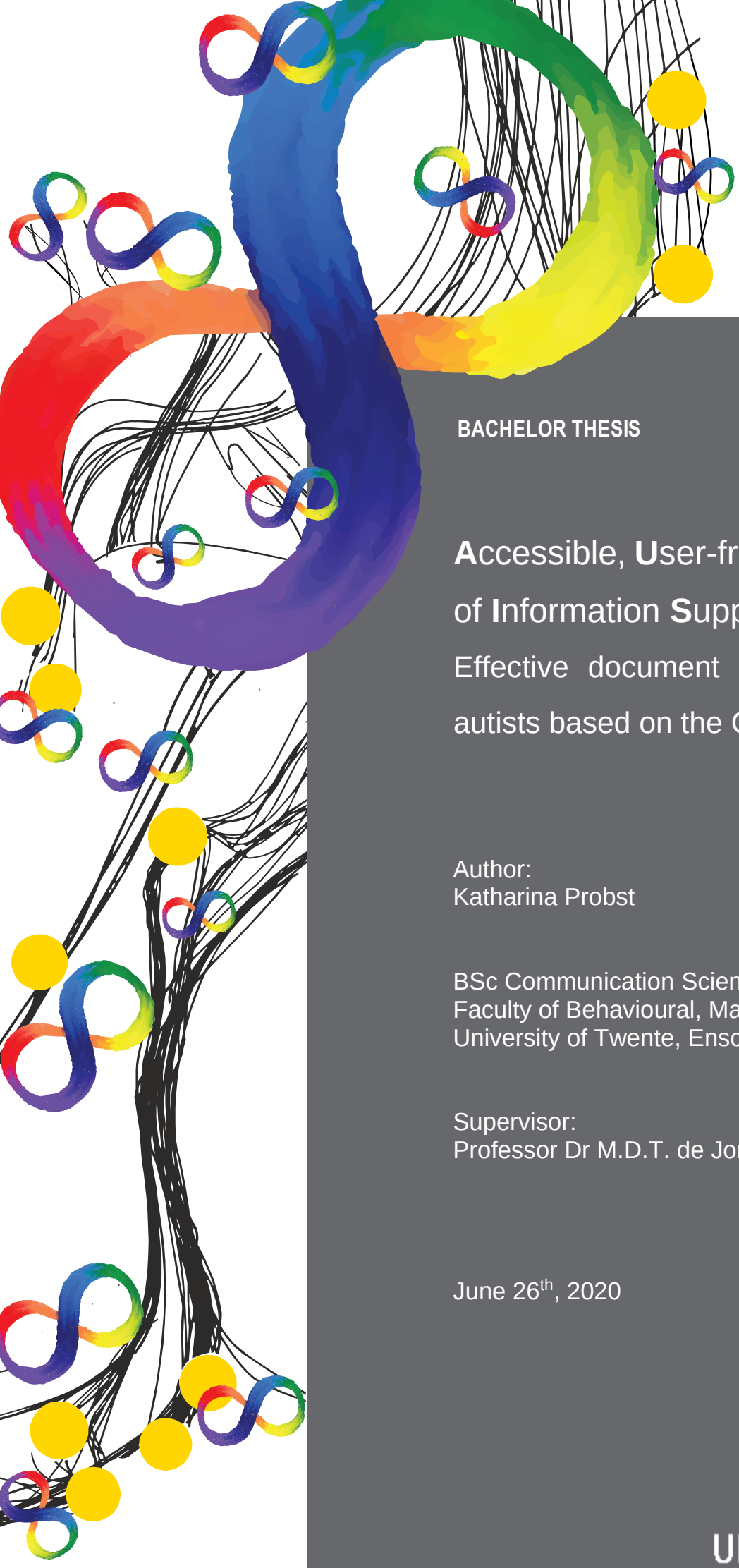

BACHELOR THESIS

Accessible, **U**ser-friendly **T**ransmission of **I**nformation **S**upporting **M**inorities:

Effective document design guidelines for autists based on the COVID-19 pandemic.

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June 26th, 2020

UNIVERSITY OF TWENTE.

Bachelor Thesis

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Thank you very much, Pascalle, for the beautiful design of the cover page. The design consists of many different aspects related to autism and especially the acceptance of autism which I see as a crucial goal for our society. I hope for a world where everyone is accepted regardless of any disadvantages and where people do more than just accept each other and instead actively contribute to a more open and inclusive world. Especially in the light of the worldwide turmoil we are currently experiencing, it should become abundantly clear that we all need to do our part in various aspects of our society.

The design highlights the rainbow-coloured infinity symbol which resembles the strive for autism acceptance in this world. Connected to it are 14 smaller rainbow coloured infinity symbols which have different sizes and orientations representing the individuality of all the amazing people with autism that I met during this study. Thank you very much for your brave and honest insights into the experiences you make on a daily basis and thank you for overcoming your inhibition to meet with a stranger to talk about what is important for you. It was a very touching experience for me to hear why you wanted to participate and what you're hoping will change in the future. I hope this research can bring all of us a bit closer to our wish for a more inclusive society. And I would like to wish all of you the absolute best for the future. You are wonderful! The 10 golden dots on the front page stand for the people without autism who contributed to this study and showed their acceptance and support for people with autism. I would like to thank you for taking the time to understand that autism can impact people more than we might expect. Thank you for being open with your answers and curious about the results. Thank you for bringing critical questions but also your encouragement to this thesis. Additionally, the usage of rainbow colours matches the other topic this research focused on namely the COVID-19 crisis. It was used to express support and wishes to cheer each other up during the pandemic which is a beautiful sentiment to a respectful and accepting world.

Lastly, I would very much like to thank my family and friends for their continuous support and for always having an open ear for my thoughts even when I rambled on about this study. For understanding and cheering me up during the ups and downs of this research, for proofreading my text, but also making sure this was not all I focused on. I am incredibly happy to have all of you in my life and I'm excited for you to read this thesis in the final version.

Sincerely yours,
Katharina

Abstract

Purpose. In today's society, effective instructional documents are needed to convey crucial information. This research determines the needs and preferences of autists regarding such documents and provides practical recommendations for future instructional design. The instructions in this study focus on the coronavirus pandemic as an example of especially relevant information which needs to be available to every citizen. Therefore, the research establishes the extent to which the COVID-19 instructions are already autism-friendly and how instructions can be improved.

Method. In this research two studies were conducted to first establish the status quo in instructions design and then verify the findings with people with autism. The corpus for Study I, the content analysis, consists of 20 instructions on how to behave during the COVID-19 outbreak. Study II consists of user testing and interviews to determine the perceptions of autistic and neurotypical people. 19 people participated in this research, 14 of them autistic and 5 neurotypical.

Results. In Study I, the instructions were assessed according to content, design and language and their general functionality as well as the implications for people with autism. Some of the instructions had autism suitable features but were not consistent in the application and improvement is needed, especially in the areas of user guidance and clarity of design. Study II found that instructions for autists should be attentive to visual aspects such as structure and design, and linguistic and content related features. An example of autistic needs is that instructions should most importantly be short and avoid unnecessary information that is not directly relevant for the material.

Conclusion. Both studies show that autistic people most importantly require that instructions are purposeful, clearly structured, and not overly complicated. The research provides guidelines on how to implement this in future document design to meet the needs of autists as well as improve the clarity for people without autism.

Keywords: Behavioural Instruction Design, Document Design, Accessibility, Inclusion, Usability Evaluation, Autism Spectrum Disorder (ASD), Coronavirus (COVID-19) Crisis

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1 - Introduction

1.1 Problem setting

In today's society, effective instructional documents are needed because they convey crucial information to people. Clear instructions are relevant, for example, when communicating appropriate responses towards fire hazards, but also on a smaller scale to explain how furniture has to be assembled. Especially crisis situations require clear communication which is effective in bringing about behavioural changes. This also applies to the pandemic our world is currently facing due to the coronavirus, also called COVID-19.

Aside from struggles which everyone encounters to access and remember all relevant information while receiving an information overload on a daily basis, some people experience extra challenges. People exposed to extra challenges are for example autists (see paragraph 2.3 for further information on terminology). People with autism perceive the world differently than people without autism (Do People with Autism Perceive the World Differently than We Do?, n.d.). This results in many aspects of the world not being sufficiently tailored towards their needs.

Such exclusion poses special risks when relevant information needs to be communicated to everyone everywhere. For example, in the case of COVID-19, people with autism are currently considered to be at an increased risk of a fatal course due to genetic factors and concurrent conditions (Lima et al., 2020). Especially the fact that not understanding or misunderstanding instructions poses increased danger for all people who need to be informed about the potential problem, shows how crucial it is for everyone to understand the instructions given.

1.2 Research context & objectives

This research focuses on the improved accessibility of instructions which should be useful and available for everyone. In this case, it especially relates to people with cognitive conditions and how the current documents meet the needs of autistic people and which improvements still need to be made. The aim of this research is to uncover the needs and preferences of people with autism with regard to instructional design and draw up practical

recommendations for future document design. As part of increased accessibility and inclusion the research aims to contribute help for people with autism to navigate the world more easily and to receive clear instructions. At the moment, there are many developmental conditions such as autism prevalent (Harwood et al., 2004). Along with many cases of such conditions comes a high demand for an accessible world. The numbers indicate that many people would benefit from designs which are tailored to their specific perceptions of the world (Barry & Pitt, 2006). This does not only apply to people with these conditions, but improved instructions could also benefit other people due to improved clarity, hierarchy, and conciseness of the document.

A situation in which the need for improved accessibility becomes apparent is for instance, when a person with a mental condition has delays in cognitive processing. When they encounter an unfitting instruction, they might have difficulties in processing verbal or written information on documents. They might also be impacted by sensory perception issues which means that sensitivity to stimuli can cause distractions or anxiety for the person (Magnée, 2008). In many cases, the resulting feelings of being overwhelmed or being unable to comprehend the information could be avoided by following guidelines which support people with cognitive conditions. So far, this requirement for accessibility is often unknown to or unconsidered by people producing instructional designs. Researchers and designers often are not aware of the specific needs of people with impairments or different perceptions while in other cases adjustments according to the needs are ignored due to higher costs and time consumption. With this research concrete and easily applicable guidelines will be proposed which enable the design of more accessible instructions.

1.3 Research questions

The research question “Which demands do people with autism have for behavioural instructions?” focuses on assessing general needs and wishes of the target group. It was derived from the current lack of guidelines for successful, accessible document design. The question aims at combining observations of potential issues on current instructions with the input of autistic people. Hence, the research consists of two parts with individual and specialised questions. A content analysis of instructional documents (Study I) answers the sub-question “To what extent do behavioural instructions regarding COVID-19 cause utilisation difficulties especially in the context of autism?”. This is to determine, in how far existing documents

already exhibit autism-oriented design choices and which aspects could be improved. In the research with user tests and interviews (Study II), the following sub-question is answered: “Which aspects of instructions are required by people with autism?”. Thereby, the target group can give input regarding their own perception and wishes on how instructions should be designed.

1.4 Theoretical relevance

Around 10% of the global population are affected by disabilities including mental or cognitive impairments (Harwood et al., 2004). Based on a literature search, it became apparent that the topic of instructional design and how it should be communicated to people with cognitive conditions such as autism is not examined sufficiently yet. Therefore, the current “research gap” could profit from further research contributing to the field of instructional design suitable for neurodiverse people (Thurm & Swedo, 2012). The topic is relevant as the accessibility for people with mental disorders is often neglected and the struggles are often overlooked in “everyday world designs'” (Scheeren et al., 2013).

The worldwide percentage of people with autism is hard to determine due to stereotyping and repercussions in some countries. But many studies estimate that around 50 - 60 million people and therefore about 1% of the global population are on the autism spectrum (American Psychological Association (APA), 2013; Hahler & Elsabbagh, 2015; Vos et al., 2016). This percentage applies to children as well as adults who are diagnosed with autism. Aside from this, many people have not been diagnosed or are not even aware that they might have autism. Therefore, adjusting instructional designs might actually help even more people who currently struggle with instructions of any kind. Generally, behavioural instructions should be understandable and memorable. And the autistic viewpoint might improve clarity for all who read it. This stems from the general autistic preference for logic, conciseness, and avoidance of errors. Those skills are also human characteristics which emerge especially in crisis situations and therefore, make the feedback of autists even more relevant (Cassidy et al., 2020).

Therefore, the research of this thesis focuses on the improvement of document design to match the needs of people with autism in order to be more accessible for many people. Therefore, this study, providing new insights about autism and document design, is needed to

identify guidelines for suitable document design. Furthermore, the research offers novel knowledge with regards to the current corona pandemic and is hence very timely.

1.5 Practical relevance

This research is of practical relevance since the findings and outcomes will be formulated as guidelines which can be used as a checklist for example by designers and content creators. These guidelines will be tailored to governmental advice due to the instructions presented in this research, but the findings will be applicable to other less institutional instructions too (Goldsmith & LeBlanc, 2004). This assures that many instructions of every kind can be more accessible and inclusive in the future (Nicolle & Abascal, 2001). Generally, the topic is closely related to many aspects of the Communication Science field which can be practically applied. The research is grounded upon usability and user experience research (Lowdermilk, 2013) and closely connected to document design (Schriver, 1998), which has many practical implications for daily life. Thereby, insights and guidelines can be applied to those areas in the future. Moreover, the research strives for clear textual and visual information and pushes towards accessibility and inclusion, which can be implemented in accessibility programs (Henry et al., 2014). Lastly, the findings may and shall add value to other areas of communication such as applications in marketing (Shore & Rastelli, 2008) and transparent organisational communication (Langdon et al., 2014; Molenbroek, 2013).

1.6 Content overview

This research consists of two studies. First, the theoretical framework will provide deeper insights into the relevant topics and variables which will then be examined in the studies. The first study is a content analysis in which the document design of COVID-19 instructions is examined. The findings were then related to autism and assessed in the second study, via user tests and interviews with people with autism. In this study, people with autism and people without autism provided their feedback and insights on COVID-19 instructions during user tests and interviews. Lastly, the findings of the entire research will be discussed.

2 - Theoretical Framework

The theoretical framework provides definitions and visualisations to establish the theoretical fundamentum to understand this research. In this theoretical framework firstly four relevant constructs which are frequently referred to are specified and explained to avoid ambiguity and misinterpretations as well as make sure that terminology is interpreted as intended. These four constructs lead towards the conceptualisation of the research which provides an overview of the relevant aspects this study focuses on before the implications are described.

2.1 Design choices

2.1.1 Instructional & document design. First, this research highly focuses on instructional and document design. Document design is the result when a document is designed in a way which will positively change a person's situation using this design (Schriver, 1998). Schriver (1998) describes that design needs to be ready to be practical, easy to use and affordable. The basic principles in document design such as seeing the user central, conducting research to support the design, and establishing the document as more than just the text provide guidelines in addition to the findings of this research (Putnam & Chong, 2008). Furthermore, the plain language movement should be considered for its holistic text approach in which writing and visual designs in any type of document are not only focused on understandability, but also usability and trustworthiness of the document (Schriver, 2017).

The term “behavioural instructional design” or parts of that phrase are referred to as well as the term “document design”. Instructional design leads to the way documents are systematically developed digitally and physically to meet the users’ needs and achieve certain behaviours or behavioural change. Thereby, status and needs of users as well as a goal are determined to create the instruction to support the transition. Commonly, the basic steps in instructional design as analysis, design, development, implementation, and evaluation are used to create and validate the document (Piskurich, 2015). A different approach to creating documents is “document design” which focuses on optimal readability and usability. To achieve this, the arrangement of elements, emphasis of document parts, clarity, conciseness, tone to convey the information, and ethos are used (Kostelnick & Roberts, 2010). With regards

to this research, both approaches are considered beneficial for the preparation of the instructions as they require optimal usability but also should encourage behavioural changes to manage crisis situations such as the COVID-19 pandemic.

2.1.2 Design principles. Relevant design principles in this study are the usage of heuristics as proposed by Wickens, the Gestalt principles, and colour theories. All three focus on the effect design choices can have on the perception of the user. Wickens' heuristics (Wickens, Lee and Becker, 2004) relate to the predictability of the documents and ensure that it is as easy as possible for the viewer to navigate through the document. The design principles of Wickens (2004) can be differentiated in four categories. Firstly, perceptual principles which are about the perception of the material for example "legibility" of all components or "avoid absolute judgment limits" which describes the distinguishability between various options based on visual cues. "Top-down processing" means information is provided in a hierarchy and builds on each other. "Redundancy gain", is for example a traffic light which shows the same information in different ways. Additionally, the "discriminability" is important since similarity causes confusion which means that all components need to be possible to differentiate.

The mental model principles are about concepts which relate to mental processing such as "pictorial realism" which means that images look like what they represent and the "principle of moving parts" matches the users expectation of how the element moves in real life. Thirdly, the principles based on attention relate to a persons' attention, such as "minimising information access cost" which entails that accessing information should not take up a lot of time and effort. The "proximity compatibility principle" entails that the closeness of components can be beneficial to establish similarity but harmful when the differences should be highlighted. Furthermore, the "principle of multiple resources" dictates that information should be provided in different forms such as diving information onto different sources in order to reduce the cognitive load.

Lastly, the memory principles related to the human memory where in order to reduce the memory load it is beneficial for the user to "replace memory with visual information" such as checklists rather than having to access the knowledge by themselves. "Predictive aiding" relates to design which helps the user to expect more will happen next in order to support the prediction the user is trying to make. The "principle of consistency" aims for a similar design for the same intention which allows the user to learn few but often used designs and therefore

reduces the strain to understand several new things every time. In this research not all components were used but the applicable principles will be referred to throughout this study.

The Gestalt principles pay close attention to how different features on a document are perceived, especially in relation to other features on the document (Broek, van den Koetsenruijter, de Jong & Smit, 2004). This could, for example, be how similar or how consistent the used texts or images are. The Gestalt principles consist of 12 rules on how to make design sorted and simple (Broek, van den Koetsenruijter, de Jong & Smit, 2004). The first rule, the "law of figure ground" describes that by distinguishing foreground and background different designs can be interpreted. A popular example for this is the picture of an old hag which can also be interpreted as a young woman instead. The "law of simplicity" follows the idea that objects can be perceived in their simplest form by providing space and structure to create a clear design. The "law of proximity" describes that elements which are close together are seen as connected while elements which are far apart are perceived as independent from another. The "law of similarity" entails that elements which look alike are viewed as a group while elements which look different from another are perceived as independent elements, for example when sorting shelves in supermarkets. The "law of symmetry" describes that elements if they are symmetrical are perceived as a unit even if there is distance between them such as statues which are identical or similar and can be identified as belonging together even if they stand on different sides of a building entrance.

The "law of similar background" describes that objects with a similar background such as for example the same background colour, form a unit for example in tables when the rows are coloured alternatingly. The "law of common fate" summarises that things or images which move in the same direction are perceived as a unit for example on traffic signs where a wheelchair and the arrow are moving in the same direction while a sign where the wheelchair would go in a different direction than the arrow would cause confusion. The "law of closure" means that even if an image is not entirely presented the brain automatically fills the gap. This is further described in the next two laws. The "law of enclosure" shows that objects which are surrounded by a line are viewed as one while objects that are separated by a line are viewed as individual elements. The "law of gap-filling" describes that if things are missing but parts of the surrounding are still present the human brain can make up for the gaps and form a logical connection. The "law of continuity" shows that objects which are presented in a continuous sequence are perceived as connected to one another. The "law of experience" means that the

human brain is inclined to compare objects with things that are already known. Due to an overlap with Wickens heuristics and only partial applicability of the laws for this research, only some of them will be referred to during this study.

Lastly, colour theories provide insights into why certain colours evoke distinct emotions and perceptions, but also why some colours work together and others do not (Itten & Birren, 1970). Understanding the colours helps to determine which colour could be beneficial and which disadvantageous depending on purpose and connection with other colours. All principles and theories contribute to a clearer understanding of the effect that design choices have on the reader.

2.2 Crises

2.2.1 Crisis communication. This research focuses on instructions regarding a crisis and therefore, certain aspects of crisis communication are considered. Crisis communication is defined as a component of public relations management, where the protection of an individual or organisation is in the foreground. It often focuses on challenges to the reputation of the individual or organisation, which is not relevant in this research. Instead, the fact that communication often relates to reactions in unpredictable situations which pose a threat to the respective group and could generate negative outcomes, which is comparable with the communication of information during a crisis such as a pandemic. For example, the consideration for the impact of online media during a crisis and the need to determine the crisis type and how information is spread and which intent a message has (Liu et al., 2011) can also be found in the documents used in this research. The instructions convey information about the crisis towards a general audience who wants to know what is happening, but also submit to governments and other organisations which communicate their expectations and rules. Another aspect in which crisis communication can be applied in this research is through the study of emotional changes throughout crises. It indicates that people involved in crises develop their emotions and opinions as the crisis progresses (Jin et al., 2010). Applied to this research, it connects to the readers' wish to use documents that keep them up to date and to receive instructions which show the most current rules.

2.2.2 COVID-19. This research examined instructional materials about the "Corona crisis". To avoid confusion due to many different terms which have been used for this crisis in

the media, these are the definitions as they will be referred to throughout this study. The crisis is happening because of the “Coronavirus Disease 2019”, “COVID-19” for short. This disease was first identified in December 2019 in Wuhan, the People’s Republic of China, and since then a continuing pandemic has developed. The virus which causes COVID-19 is the “severe acute respiratory syndrome coronavirus 2”, also referred to as “SARS-CoV-2” or more generally known as the (novel) “Coronavirus”. The disease commonly exhibits symptoms such as fever, cough, fatigue, shortness of breath and sometimes loss of smell and taste (ENT UK, 2020). While the majority of people may experience mild symptoms, severe cases progress towards multiple organ failure and death (Murthy et al., 2020). It is usually spread through small droplets which are set free during coughing, sneezing, and talking. This is especially the case when people are in close contact with each other.

As a measure against the spread of the virus, increased hygiene such as hand washing and usage of masks to cover faces have been applied globally. Additionally, social distancing is adopted by the majority of the world population, meaning that everyone keeps, depending on the country, one or two meters distance from each other. Moreover, quarantines have been implemented for infected or potentially infected people, lasting from the usual onset of symptoms after two to five days until the end of the incubation time (after 14 days) or until all symptoms have subsided (WHO, 2020). For this research, it is important to note that different countries apply different measures to fight the spread of the virus and that therefore the presented instructions provide different information. Furthermore, due to the fact that the pandemic is ongoing, the measures to stop the spread have changed throughout the research and are expected to change after the research is concluded.

2.3 Autism

2.3.1 Autism spectrum disorder. The target group of this research consists of people who are diagnosed to have an “Autism Spectrum Disorder” (ASD) and to be on the “autistic spectrum”. Autism is categorised as a neurodevelopmental disorder, commonly expressed through symptoms such as difficulties in social interaction and communication as well as restricted and repetitive behaviours (Filipek et al., 1999). The fact that it is called autistic spectrum is often interpreted as being very linear, ranging from “not autistic” towards “very autistic”. This is not a fitting representation for the autistic spectrum since a “multidimensional

spectrum" summarises better how autism is exhibited. For example, people with autism might deviate from typical perceptions and behaviours in some areas, while they do not differ from the "average person's brain" in other parts. According to Burgess (2016), areas which could be found on this spectrum, which is based on the colours spectrum for visualisation purposes, are language, motor skills, perception, executive function, and sensory filters (Figure 1). Due to the fact that people show different traits to a different extent, autism manifests itself in many different ways.

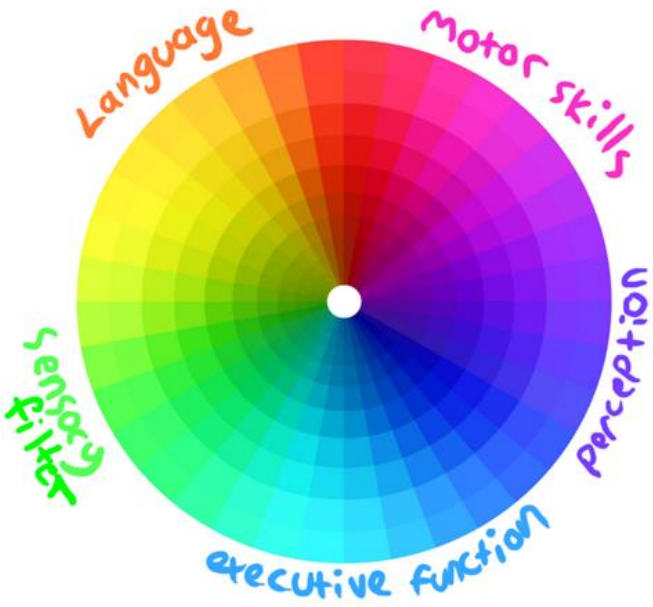

Figure 1. Excerpt and completion of a visualisation of the Autism Spectrum titled "Understanding the spectrum" by Rebecca Burgess. Retrieved from https://theoraah.tumblr.com/post/142300214156/understanding-the-spectrum.

There are different types of autism, which are positioned on the spectrum. Depending on the definition, initially five currently usually three types of pervasive developmental disorders are assigned to the spectrum. Ranked from the supposedly least severe to the most severe stages are the Rett Syndrome, Childhood Disintegrative Disorder, Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS) (also called atypical autism), Asperger's Syndrome, and the Autistic Disorder (also called classic or childhood autism). Due to a revised classification, new diagnoses do not define the Autistic Disorder, Asperger's

Syndrome, and PDD-NOS separately anymore, but generalise them as Autism Spectrum Disorder (Volkmar et al., 2009). In this research, especially Asperger's Syndrome as well as the Autistic Disorder are referred to due to a larger similarity in symptoms and causes.

Autism is often identified when a child has the age of two or three and some developmental milestones are not reached traditionally or skills worsen after reaching a "normal" milestone. However, it also can happen that autism is only detected at a later stage throughout life, in some cases even only around the age of 80 years. The condition is long-term or life-long lasting and potential causes are genetic and environmental factors (Szpir, 2006). It is important to note that, opposed to common stereotyping, autism is not necessarily visible and therefore, people are generally not easily recognisable as having autism. While in many cases autism is not immediately recognisable, the autism can often lead to people being (temporarily) mute or showing severe speech impairments (Steffenburg et al., 2018).

With regards to the prevalence of autism, a debate is taking place trying to explain the increase of people who get diagnosed with autism (American Psychological Association (APA), 2013). The increase in autism diagnoses can stem from several changes, for example the expansion of diagnostic criteria in the Diagnostic and Statistical Manual of Mental disorders (DSM-5). This extension led to the inclusion of threshold cases, i.e., several types of autism which used to be defined separately, such as Asperger's that increased awareness of autism. Additionally, the assessment of autism has changed in the last years and might now identify more people on the spectrum that would not have met the criteria in the past. Furthermore, potentially, there is an actual increase in people with ASD and the prevalence might truly have risen compared to previous years (American Psychological Association (APA), 2013).

Currently, there is a discussion in the autism community regarding the name of the diagnosis "autism spectrum disorder" (Kenny et al., 2016). Many people feel that this term has been chosen by people who do not have autism themselves and who view the condition as something that should be cured. This causes disagreement from the community which does not see themselves as having a disorder and perceiving the terminology as stigmatising (Stevenson, 2015). Based on this, the thesis will simply refer to ASD as "autism" instead. Additionally, there is much disagreement regarding how people on the spectrum want to be addressed. One option is following a "person-first approach" leading to the term "person with autism", which tries to point out that there is a person aside from the autistic traits (Nelson, 2010). Contrary to this option, many people with autism advocate that this approach makes it seem as if "having"

autism is a bad thing and something which could be changed. Instead, they propose an "identity-first approach" advocating the phrasing "autistic person" which views autism as a crucial part of the person (ASAN, n.d.). This study does not want to determine which approach a person should use and prioritise, as this is a personal choice. Therefore, the terms "person with autism" as well as "autistic person" and the diagnostic term "autist" (Hendriks, 2012) will be used interchangeably in this research.

2.3.2 Neurodiverse/neurotypical. In this study, people with autism are also referred to as "neurodivergent" (ND) due to their versatile cognitive system. The term was coined by autistic communities and summarises anyone with a variation to the human brain which deviates from the "typical" structure (Armstrong, 2011). Currently it is more common to refer to "neurodiversity" which will be adopted in this research. The term "neuroatypical" is sometimes chosen to refer to neurodiverse people but will not be used in this thesis due to its stereotyping nature. The term for people without autism is "neurotypical" (NT), since it refers to people who do not have any developmental disorders and are, therefore, typical. In some cases, neurotypical people are called "allistic" to differentiate from people who are neurotypical but may be atypical in another way, for example by having dyslexia (Cashin, 2006). The term allistic falls outside of the scope of this research and will not be used due to the fact that neurological atypicalities besides autism have not been determined for the neurotypical participants.

When comparing neurodiverse and neurotypical people, it is important to note that, in many cases, the world is oriented towards a neurotypical perspective. This for example also has the consequence that communication problems between neurotypical and neurodiverse people are commonly attributed as the neurodiverse person's fault. Instead, it is useful to be aware that the communication between neurodiverse people often works successfully and difficulties arise when neurotypical people assess the communication style (Morrison et al., 2019).

2.4 Accessibility, inclusion & universal design

The research aims for a world which puts accessibility first. By taking an accessibility focused perspective, a person strives for design of products, services and environments which make it usable for people with disabilities (Henry et al., 2014). The design ensures direct access

which means the person does not need assistance or indirect access through the facilitation of supportive programmes such as screen readers with which the persons can still access the products. Accessibility provides people with the ability to access things and make use of the features like everyone else. Another related aspect is inclusion, which strives for everyone taking measures to accommodate people with any form of visible or invisible disability or condition. The goal is to avoid people being excluded due to their physical or mental condition and can partake in society (*Disability Inclusion*, n.d.). An approach to make this happen is the so-called "universal design". It aims at not only offering access to people with disabilities, but actively creating environments in which all barriers physically or mentally e.g. stairs or concentration, are designed in a way which can be used by everyone with or without such a condition (North Carolina State University, 1997). This research also aims at overcoming such barriers and therefore, is related to all of the three terms.

2.5 Conceptual research model

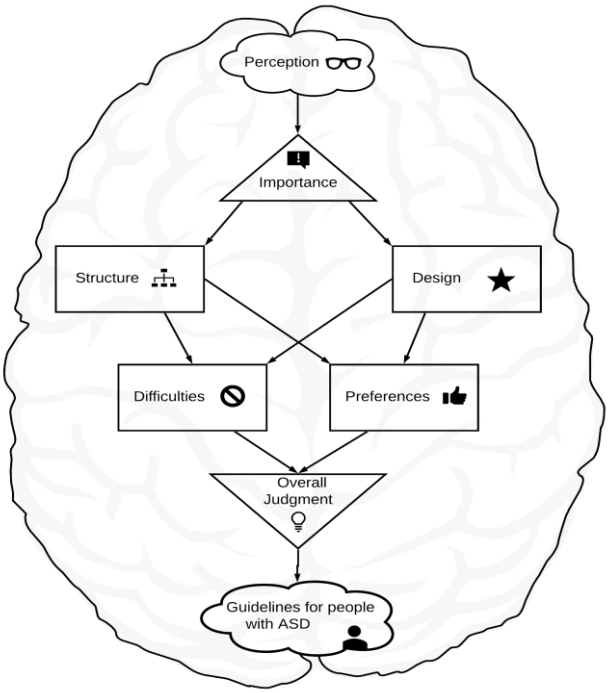

Figure 2. Usability evaluation and effects on the accessibility of sub-optimal instructional document design in crisis situations. Specifically, applicable to an analysis of perception and difficulties based on the example of Covid-19 pandemic documents for people with autism (ASD).

The conceptualisation of the study, Figure 2, is visualised in a funnel design representing the intake and retainment of information. Furthermore, the steps the information takes during the assessment are placed according to their respective role and position in the left or right brain halves of a person. The study's conceptual research model visualises the most important aspects which enable the establishment of guidelines for people with autism. The conceptualisation consists of seven categories which follow a flow chart design from top to bottom. Starting from the perception of a person looking at the documents, the information about the document design is filtered through four steps during which an opinion is established. Initially, the participants take a first look at the document to get an overview. Subsequently, they assess the importance of the document in order to decide if they want to continue looking at the instructions. In this step, the relevance and credibility of the design are assessed to determine if the provided information seems crucial and trustworthy enough to invest time in reading the instruction. Afterwards, the attention focuses on structure and design of the document where the visual and content clarity of the document is determined. In the next step, the viewer gathers knowledge about the document and rates it according to likes and dislikes such as difficulties when using the instructions and its preferred aspects. Together with such a judgment of the provided information, lastly, the overall judgment and plausibility of the information is assessed. Here, completeness and comprehensibility of content and design are examined.

Such an assessment leads to clear distinction and formulation of necessities for document design and potential avoidances which should be evaded. The feedback, especially if mentioned by several participants, can be used as guidelines for future document design. The conceptualisation of this study applies to user tests with people with autism as well as people without autism. Overall, it allows the exploration of documents, the evaluation of the information provided, the creation of guidelines and therefore the management of future instructions. The conceptualisation includes pictograms to support the information provided as it has been appreciated by the participants of this study. Additionally, the conceptualisation model is embedded in the shape of a brain due to autism being a cognitive condition.

2.6 Implications for the research

The focus of the research towards COVID-19 instructions and tailoring towards people with autism determines who is a part of the target group and provides direction regarding the instructions to be tested. Furthermore, in order to answer the research question, qualitative research is applied to provide suggestions and guidelines. The content analysis creates an overview and allows the examination of behavioural instructions worldwide to establish potential difficulties in such documents. The user tests and interviews build upon these insights and enable in-depth responses about preferences of the target group. In this way, the guidelines can be built upon the wishes of the people they are supposed to serve. The comparison between neurotypical and neurodiverse views on the same documents establishes an indicative understanding of the differences which both groups perceive. This results in the opportunity to provide recommendations which, if followed, enhance the user experience of people with autism without causing difficulties for anyone without autism by avoiding overload and providing clearer structures.

3 - Study I

This research will add to the constructs and research discussed in the previous section. It will shed light upon the accessibility of ordinary behavioural instructions regarding crises as the novel coronavirus outbreak for people with autism. The instructions chosen for the research are the ones that aim to impact behaviours in crises, such as the current COVID-19 situation. If communication is successful during crisis situations where highly relevant information needs to be conveyed, the instructions are also suitable for normal situations. Such instructions, more so than others, need to be clear, comprehensible, and possible to remember as well as be effective to change behaviour (Piskurich, 2015).

The content analysis is applied to conduct a thoroughly grounded user test and research in-depth insights about this specific topic (Neuendorf, 2016). The content analysis has the aim to determine the status quo in the instructional design of COVID-19 documents and evaluate the current documents with considerations for the autistic perception of the instructions. Furthermore, it attempts to determine potential guidelines for autism-friendly design based on points of criticism and appreciation in the presented instructions which will be verified in the next study with autistic people. Study I addresses the sub-question "To what extent do behavioural instructions regarding COVID-19 cause utilisation difficulties especially in the context of autism?" from a perspective focused on accessibility. The results of the content analysis will be further examined in interviews and user tests later on.

3.1 Method

3.1.1 Corpus. The corpus for the content analysis was chosen from many potential instructions on how to behave during the COVID-19 outbreak. Firstly, it is essential to note that the documents were gathered on May 3rd, 2020, after which some new or revised documents have been published. For this study, twenty relevant documents were gathered to get a comprehensive overview of the various instructions about COVID-19 available in society. The instruction type can vary from posters to social media materials but has to be publicly available, be intended for a broad audience to see, and an English translation has to be provided. First, a sample of instructions was gathered via a Google search regarding "Corona Instructions" and "COVID-19 Instructions". The search terms started broad and over time, they were narrowed down to multiple specific searches regarding certain countries ("Coronavirus [Country name]") as well as specific research on the government websites of countries in the

focus of the pandemic. Initially, potential documents which are easily accessible for the general public were inspected and filtered to assure the quality of the sample used in the examination. Forty documents from many different parts of the world were assessed based on the first impression they conveyed. This means that very illegible and crowded documents were not considered. Furthermore, it was assessed how error-free the documents were in order to assure that they did not distract the user during the usage.

Eventually, twenty documents remained in the sample which was retrieved at the beginning of May 2020. The exact versions can be found in Appendix 3. The instructions stem from governments of various countries and allow the assessment of guidelines for people with autism despite country-specific differences since they focus on the way the information is presented and not on the particular information that is given. The instructions inform about what the virus is and how to recognise it. They focus on how to protect oneself and others or instruct to practise hygiene to stop the spread. Additionally, the documents were chosen as a purposeful sample based on knowledge of the Covid-19 crisis. Therefore, countries where the virus originated, as well as where the impact of the virus was the largest were specifically included. Furthermore, instructions of countries which chose quite different approaches to fight the virus were incorporated as well.

In addition, it was decided to opt for documents of reliable sources with higher esteem, which are published by the government or other well-established institutions. This choice assures the reliability of the instructions and that they are realistic to be used in the population. Therefore, self-made designs as they can be found on social media have been excluded since they do not provide a complete overview, as they might be cropped or parts self-redrawn. This does not allow a full insight into the information initially provided. Moreover, in order to compare many different instructions, one has been chosen per country. In cases of documents for certain groups of people such as academics or people with autism, the function of the documents has been viewed above the country of origin. All instructions aim to inform about the novel coronavirus and to show their reader ways to reduce the spread of the virus or how to protect themselves.

3.1.2 Codebook. The basis for the content analysis is the development and utilisation of a codebook (see Appendix 4) to assure replicability of the research. For the codebook, a mixture of top-down processing followed by a bottom-up approach was applied as follows. First, the establishment of codes for the codebook followed theoretical research about

document design and analysis about rules established to tackle the COVID-19 crisis. Based on such theoretical knowledge, the initial codes were derived with a deductive ("top-down-processing") approach (Potter & Levine-Donnerstein, 1999). Additionally, the codebook was enriched by design-related codes such as heuristic (Wickens, Lee, & Becker, 2004) and Gestalt Principles (Broek, van den Koetsenruijter, de Jong & Smit, 2004) and consideration of the mental capacities of the readers (Mayer & Moreno, 2003).

In the following, the documents were inspected and based on observations of the document's noteworthy features, e.g. the direction of writing, codes were added to the codebook. This concerned the establishment of main codes and the majority of subcodes via an inductive ("bottom-up-processing") process, which allowed the subcodes to match all cases and to avoid any confusion (Mayring, 2000). This yielded a codebook with general, literature-based codes as well as specific, case-based codes. Overall, 159 codes have been established in 21 categories, which can be divided into three groups, namely "form codes", "content codes: design" and "content codes: language". Table 1 provides an overview of the components of the codebook.

Table 1

The shortened codebook with all 21 Codes. Including the form codes to describe the document itself and content codes to analyse the design and language

	Main code	Subcodes	Definition
Form Codes	1. Document Name	.....	....
	2. Publication Type	2.1 Social Media File 2.2 Poster	The intended publication version, social media, infographic, or poster mentioned on the page where it was retrieved.
	3. Publication Date	...	...
	4. Publication Location	...	...
	5. Publication Focus	5.1 Protect 5.2 Information About Coronavirus ...	The message that is in the focus of the document.
	6. Intended Audience	...	...
	7. Actors Mentioned	...	...
	8. Referral	...	...
	9. Language	...	...
Content codes - Design -	10. Colour	...	...
	11. Illustrations/Images	11.1 Size 11.2 Positioning	... 2. The role the graphics and drawings play on the poster.
	12. Text	...	...
	13. Symbols / Pictograms	13.1 Wash your hands 13.2 Don't touch your face 13.3 Recognise Symptoms ...	The behavioural instruction provided/supported by pictograms. This means figures visualising one actions without much additional detail.
	14. Heuristic Principles neglected	... 14.3 Top down processing 14.4 Redundancy Gain ...	... 3. Designs don't match the expectation of the viewer. 4. Information is not provided in more than one version. ...
	15. Gestalt Principles neglected	15.1 Law of Simplicity 15.2 Law of Similarity ...	... 1. There is no appealing amount of information, structure, orderliness and white. 2. Elements that seem alike are not grouped. ...
	16. Other Remarkable Features	... 16.3 Visibility of Publication Date	... 3. The publication date is shown on the document to indicate the contemporariness.
Content codes - Language -	17. Length of sentences	...	...
	18. Style of Document	18.1 Information overload 18.2 Paragraphs	1. There are more than 7 +/- 2 chunks of information provided 2. Paragraphs used in the text
	19. Wording	19.1 Colloquialisms ...	1. Non formal language ...
	20. Rhetorical Devices	20.1 Assonances & Alliterations 20.4 Tricolon	1. Same letter or sound at the beginning of close words. 4. A series of three words
	21. Other Remarkable Features	21.1 Slogan ...	1. Memorable phrases used to enforce the message ...

As indicated in the table, the codes summarise different aspects of the instructions. The "form codes" have nine categories which provide background information about the instructions inspected such as:

- Country the document is from
- Type of document e.g. poster or a social media post
- Publication date of the document
- Publication location i.e. government site or social media page
- Focus of instruction e.g. topic
- The intended audience
- Actors mentioned i.e. the government of the respective country
- Referral to e.g. websites or phone numbers for further information
- Language used in the document

The second group, “content codes: design” with seven categories focuses on the usage of design features to convey information:

- Colours used in the document
- Categorisation for illustrations or images
- Layout of text on the document
- Purpose of symbols or pictograms
- Adherence or neglect of heuristic principles
- Adherence or neglect of Gestalt principles
- Remarkable features e.g. symbolism of the design, direction of writing

The third group, “content codes: language” identifies five language-related aspects which stand out:

- Length of sentences & comprehensibility of the text
- Number of paragraphs
- Wording e.g. colloquialisms, phrases, and frequently used words
- Rhetorical devices i.e. assonances or alliterations, parallelisms, tropes and tricolons
- Remarkable e.g. slogans, typos

To establish the reliability of the codebook an intercoder reliability with 20% of the documents has been tested. This means that four documents have been coded by two coders who then compared their choices. The four documents were chosen per random number generator ranging from one to twenty. 20% of the instructions, namely the documents of Australia, Canada, Japan, and the Netherlands were coded to establish the reliability of the codebook. The intercoder agreement with Cohen's Kappa value of .81 is excellent. Aside from a very satisfying Cohen’s Kappa value for the entire codebook, each of the three code groups also yielded a very reliable Cohen’s Kappa value separately, namely, .91 for “form codes", .70 for “content codes design”, and also .70 for “content codes language”. This high intercoder reliability qualifies the codebook to be used as a suitable framework for the coding of the remaining documents. During the joint coding, some definitions have been refined in order to avoid ambiguities. This also includes the agreement that the same code is only used once per

document, such as only coding the same blue background colour once although more parts of the document contain the same colour. In a case that several different background colours are being used, the code is mentioned per colour as well as noticeable colour intensities (dark blue, light blue).

3.1.3 Analysis. Atlas.ti was used to code the twenty documents. Additionally, it was employed to execute comparison and query analyses. When two codes which relate to colours are coded at the same location it is possible to see the impact colour combinations can have on the contrast and legibility of the document.

The form code "Publication Date" is influenced by the timeframe of the pandemic, which means that the chosen instructions have been published between February 2020 and May 2020. For five of those, it was not possible to determine the publication date, but the others indicate a peak in March, where at least 40% of the documents have been shared with the public. Nonetheless, it should be noted that most countries are at different stages of the pandemic and that the comparison of particular documents relative to the publication point could be interesting for further research.

The publication types indicate which types of instructions have been released. With a proportion of 50%, the most common choice is a poster format, followed by Print Resources (30%), which allow the instructions to be spread in a reputable manner. The publication type and location might influence how much people with autism will be exposed to information. Since they tend to try to avoid too much social interaction, they might frequent digital media or encounter documents, such as posters, during commutes and absorb the knowledge.

40% of the documents focus on the provision of instructions throughout the pandemic, and 30% of the documents have the publication focus "Prevention of the Coronavirus spread". This indicates that it is deemed important and/or expected to be most relevant for the reader to learn how to behave rather than gathering additional information about the situation. A clear majority of the documents is aimed at the general public (70%) and the other documents can also be accessed publicly but might be more interesting for specifically addressed groups such as travellers, pet owners or people with (affiliation to) autism. Many documents entail logos or names of other affiliated actors, such as the government, health ministry or the World Health Organisation (WHO). On average, the documents contain 1.35 logos of other actors, which are often included to provide credibility and additional information.

3.2 Results

The following codes stood out the most, especially related to the perception by people with autism. A complete overview of all findings can be found in Appendix 5.

3.2.1 Content. Regarding the content of the documents, especially the referral to sources and the design of paragraphs stood out the most.

Referral. The proper referral to information sources is to be considered from a perspective of people with autism or visual and hearing impairments. Most documents provide various ways of finding information, which can be too much or not attuned to the needs of the user groups. For example, the instruction from Israel offers only phone numbers to get more information or help. This can be largely uncomfortable for people with autism or be a reason to stop their search for information if they are not willing to find information by themselves (Hoch et al., 2009). Additionally, it can be counter-productive to provide several separate websites that might be relevant for the user, as they do not provide enough structure and guidance, for example, in documents for educational institutions (Kostelnick & Roberts, 2010).

Paragraphs. When looking at the number of paragraphs, it becomes apparent that it is more likely that a document causes information overload if there are no paragraphs than when paragraphs are generally purposefully used. In some situations, the number of paragraphs is high and the relation between them is small. Because of that, it can lead to information overload (Mayer & Moreno, 2003). An example of this overload can be found in the Canadian document which provides text grouped per topic, but still fails to guide the reader on how to read the document. This results in unclarity on the order of the paragraphs and how the information should be processed. Within documents, there are different ways to sort paragraphs and to provide structure. Some documents organise the information in two blocks and highlight the relevant aspects which will be provided in each block. Other documents did not group information spaciously, but instead clustered it together particularly close which makes it hard to differentiate between chunks of information. Another option that occurred in the reviewed documents is the provision of information in enumerate form. For example, the usage of bullet-point lists can be especially beneficial in order to list similar important information which the reader should be able to quickly see and remember (Djonov & Van Leeuwen, 2013).

3.2.2 Design. The design aspects of the documents can be related to colours used in the background and for the fonts. The decorative usage of images as well as the applicability of Gestalt principles and the design heuristics is defined according to Wickens et al. (2004).

Colours. The most frequently used background colours for these documents are blue and white. This can be explained because blue is perceived as a calming colour and white is a standard colour for the background of informative documents (Itten & Birren, 1970). The fonts use these colours with the additional option of black writing. This is a standard choice for document design as it provides good contrast especially on white backgrounds and is generally easily readable (Broek et al., 2013). Documents where this is not the case, for example, the documents intended for Africa or the Netherlands, stand out because they appear differently, which, on the one hand, could grab attention but, on the other hand, might be disregarded as irrelevant because they seem less serious and reliable.

Positioning of graphics. Another aspect that stands out is the frequent usage of graphics. At the same time, the relevance of the graphics demonstrated by their positioning might not match what they show. This means for example images which are intended as decorative often appeared in the foreground and therefore, prominently on the document although they did not convey important information. Similarly, several graphics have also overlapped other information provided on the instructions. This increases the difficulty for the reader to find the desired information without getting distracted. Such unclarity is especially crucial for people with autism who prefer to focus on exact information and do not see a reason for additional features (Siegel et al., 1996). Exclusively in the designs from China and Japan, the illustrations were used for informative purposes instead of decorative ones. Those illustrations were evaluated as beneficial due to the clarity and setting they provided in addition to the text. And it is predicted that this will enable the reader to visualise the behavioural instructions. The drawings also depict characters clearly and therefore, successfully communicate the necessary information to the reader. Through such a depiction, the designers also create a friendly interaction with the user. (Li, De Jong, & Karreman, 2020).

Pictograms. Pictograms are small symbols which indicate a situation with little detail such as a small floppy disc image communicating the possibility to save a digital document (Davies et al., 1998). On average, every document has 7.5 pictograms to indicate or support the behavioural preference for the reader. Although the actual prevalence of pictograms on instructions ranges from 0 to 21. The usage amount shows that a noticeable part of the

communication is done via these symbols. However, this usage varies among documents: some documents extensively utilise pictograms while others use no visualisation at all. Pictograms are commonly used to indicate how to sneeze or to keep a distance from others. In some documents, they also show which behaviour is correct and what should be avoided. Frequently, the reader is reminded of ways to properly wash the hands, to follow encouraged behaviours and instructions as well as observing hygiene.

Heuristic Principles. 50% of the documents were marked with the code "neglected top-down-processing", which describes insufficient matching of the expectation and the actual design in respect to clarity of function. This means that in half of the documents the instructions' layout caused confusion and did not provide the reader with any guidance of what to expect, or in worse cases, mismatched the expectations. Additionally, 35% of the documents have insufficient visualisation because they are missing the "Redundancy Gain", which provides the reader with more than one way of accessing information. It is suggested that documents provide more than one option to gather information, which would commonly be a simultaneously visual and auditory confirmation. In document design, the user can be supported through the provision of information in textual and graphical form (Schriver, 2010). This also indicates the need for such visual support to increase the clarity and user-friendliness of the designs. Another main concern is the legibility problem in 55% of the documents, which means that often information to be conveyed might not be perceived as intended because the reader cannot decipher the text. This is also supported by criticism of information overload, which, as mentioned above, means that the reader has to process too much, finds ungrouped information and has very little chance of retaining the information (Mayer & Moreno, 2003). On top of that, 40% of the cases were coded because the relevant information did not stand out or could not be found easily enough, which is no easy and effective access leading to potentially important information being ignored.

3.2.3 Language. With regards to language aspects of the documents, especially the use of rhetoric devices and sentence lengths stand out.

Rhetoric devices. Most documents make use of rhetorical devices. Of these devices, the tricolon is most frequently chosen which means that information is provided in threefold. Especially the Canadian and Dutch posters largely take advantage of rhetorical devices which creates a nice reading flow. They provide information in steps of three, include alliterations or make use of a so-called trope where they refer to a military phrasing wanting to combat Corona.

Sentence length. With respect to the usage of sentences, especially the Chinese, Dutch and Spanish documents as well as the documents regarding education stand out, i.e. they use, particularly many sentences. At the same time, it is relevant to differentiate between the relative length of sentences compared to the number of sentences used to get a relative overview and gain insight into the effect and potential cognitive load it could lead to. For example, while the Chinese document contains relatively many sentences, most are categorised as short sentences and therefore, the percentage of long sentences is very small. On the contrary, the document regarding educational facilities and the document for Spain have many sentences which are quite long. This is especially problematic since reading long sentences makes it harder for the audience to comprehend the information fully and quickly because they need to process a lot of text (Mikk, 2008).

Overall, these aspects might stand alone but also impact how the entire layout of the documents is perceived. Therefore, it is crucial to limit errors and enhance benefits to make sure the document is well perceived by the readers. To sum up, the above-mentioned analysis shows that although around 35% of the design choices are already done well, there is still improvement needed, especially in the areas of user guidance and clarity of design.

3.3 Conclusion

The coding of the instructional documents gives insight into the most common practices and potential pitfalls of document design regarding information about the COVID-19 pandemic. An interpretation of the results highlights which aspects are common, remarkable, or criticised and from an autism oriented viewpoint, some preferences stand out. The main results were that for the content, referrals and paragraphs need to be provided and chosen suitably. Regarding design the usage of colours, positioning of elements, usage of pictograms and adherence to heuristics were crucial. The most important linguistic findings were the rhetoric devices and sentence length.

In order to get the reader to even consider the document, several things can be adjusted. Firstly, it could be useful to define how and based on which factors people with autism perceive credibility of instructional designs. Apart from that, it should be considered which contact information the instruction refers to, such as avoiding documents which force the reader to use one defined option, e.g. a phone number, instead of giving a choice. Moreover, when creating

the documents, it should be paid attention that the paragraphs are clearly structured and not too long.

Regarding the design, providing the publication date and preferably information on the time frame in which the information will apply might satisfy the need for structure and knowledge in advance, which many people with autism display (Filipek et al., 1999). Moreover, people with autism generally tend to be very precise and might benefit from explicit, detailed instructions on how they are expected to behave (Quill, 1997). Therefore, the usage of short commands, especially when combined with pictograms might not be sufficient in the provision of information. Moreover, addressing a different aspect, since the illustrated documents (e.g. from China) were perceived as very clear by the researcher, it could be interesting to examine the perception of such documents by people with autism in order to confirm the hypothesis of them being of good usability.

To improve the clarity and conciseness of the documents some adjustments should be made. Momentarily, many instructions try to address different foci at the same time, such as giving information, providing instructions, and appealing to the user's willingness to help out. For some people with autism, this might add confusion due to the amount of information they need to process. Additionally, it might create pressure for them because of the expectation that they have to understand and display the emotions required in such a crisis situation. For those who already struggle with changes, more than neurotypical people, especially crisis situations might lead to stress. Unclarities due to problematic legibility and information overload can lead to unnecessary stress and feelings of being overwhelmed that could be avoided. The usage of many foci at the same time might also lead to unclarity regarding the most relevant aspects. As people with autism already have difficulties with the facilitation of Gestalt principles (Brosnan et al., 2004), any instructions that neglect guidance might cause even more problems for a reader with autism. These expectations give an idea of some guidelines which could be defined to provide people with autism with beneficial user instructions. Therefore, these considerations will be used to design the interviews and user testing in order to verify the assumptions which the content analysis recommends.

4 - Study II

4.1 Method

Building on the previous literature research and content analysis, the second study also includes the opinions of people with autism. This second study applies a qualitative methodology to gather in-depth knowledge about the perceptions of the participants. The strategy is case-oriented as it focuses on the design of behavioural instructions which are used during the COVID-19 crisis. In this comparative research, two different types of perspectives on behavioural instructions are compared (Lor, 2012), namely the neurodiverse view (that people with autism perceive) and on a smaller scale, as indicative research, the view of neurotypical people. Such a comparison enables the assessment of perceptive differences and similarities between both views. This makes it possible to discover which aspects are crucial due to the autistic view and which aspects are generally preferable for future design. By providing tangible guidelines, the results can be put into practice in the future. The study was approved by the BMS Ethics Committee of the University of Twente (see Appendix 1).

4.1.1 Study design. The research consists of user testing and interviews which were conducted with both participant groups. According to the theoretical framework, their perceptions were inquired and difficulties and preferences were determined. Their responses were then grouped depending on their relation to cognitive overload, structure of the document, credibility of the document and stylistic acceptance. Furthermore, it was assessed how the completeness, comprehension and relevance of the documents were discerned. All this led to the establishment of guidelines designers should consider when designing documents which are (also) accessible for people with autism.

Set-up. The user-focused evaluation combined different methods. Beside others, the think-aloud method was applied during the user testing where the participants were asked to verbalise their thoughts instantly. Moreover, they were asked to indicate their opinions via a verbal plus-minus method after their free exploration of the instructions. At all times, they were asked open-ended questions which were extended through probing questions whenever necessary. Being able to ask further questions enables the researcher to yield good results which allow to get a clearer understanding of the participants' viewpoint (Boeije, 2010). In addition, the bracketing method was facilitated to enable open-minded exchanges with the participants regardless of previously gathered knowledge (Boeije, 2010). Moreover, the user tests and

interviews were conducted via computer by using digital communication programs such as Skype. The data was recorded on a digital audio recorder and transcribed using a text processing program. The transcription was anonymised and personal data such as the demographic responses were stored in a separate and not-personalised document. Furthermore, references to private experiences and exact explanations of technical difficulties were summarised, but the information was not kept in the transcriptions to avoid any referrals towards the participants. This included asking family members for help with using the computer or mentioning contact options such as their email addresses.

Sampling. The resources to contact participants for this study were autism organisations in Germany as well as personal contacts. This assured that participants were actually people with autism and did not just make it up for the study. For the neurodiverse part of the study, it was an inclusion criterion that the participants were at least highly likely thought to have autism. For the neurotypical participants, it was asked if at any point they had been considered to potentially have autism. This would have been a reason to exclude them from the comparative group and ask them to participate in the autistic group. Due to the nature of the research as a digital study requiring a certain amount of English proficiency as well as the ability to express oneself, people with the mute form of autism could not be included (Steffenburg et al., 2018).

Procedure. The relevant research tools which were applied are user tests in which respondents could voice their impressions, views, and feedback about the documents. They were also asked to specifically mention what they liked and disliked about the documents. Additionally, they were asked to mention what they focused on and how they perceived the structure, the design and the amount of the information provided. Furthermore, they were encouraged to mention any aspect which they found noteworthy and to explain how autism impacts them and their perception throughout their everyday life. Within the structured interview component, the participants were asked to reflect on the documents they liked the most and the ones they liked the least in order to explain which aspects they found crucial. Moreover, they were asked to provide suggestions on things designers of such instructions should do or not do in the future. Lastly, they were asked demographic questions in order to provide a good overview of the participants of this study. In addition, the participants took part in a user test via the online communication platform Skype and in a few cases alternatively via Google Meet and Zoom. Some interviews were done via phone calls, in cases of technical

difficulties. The participants received the documents via the chat function of the digital communication platform or via email. The conversation was (video)-recorded to enable the interpretation of noteworthy observations while the respondents thought out loud. This input was used for the development of guidelines for instructional design and suggestions for future designs will be given.

Pre-test. In order to assess the quality of the research design, a small scale pre-test accompanied by a cognitive interview was conducted. The pre-test was conducted with three people who also meet the age group (18-63) of the participants of the main study. The participants knew they were participating in the pre-test and therefore paid attention to issues of the research. They reported potential issues throughout and reflected on them at the end of the pre-test. Two of the participants belong to the general public while the other participant is a researcher with experience in qualitative research regarding document design. The pre-test was done in order to analyse common flaws of documents from a neurotypical perspective with the result that the documents which have been presented to the participants were evaluated and one of them was replaced. Additionally, as a result of the pre-test, the method was adapted so that the instructions were presented to the participants in a different order to avoid biases. Moreover, this pre-test led to the adjustment of the interview questions. The questions enquired about the participants' first impression and addressing potential problems. The cognitive interview was employed to take any feedback of the participants of the pre-test into account to benefit the methodology of the research. The input from the pre-test proved useful to assure the understandability and a reasonable amount of questions addressed to the participants.

4.1.2 Data Collection. The data collection describes which documents were presented to the participants of this study and provides insight into how the research was conducted.

Materials. The five documents the participants were provided with were chosen from the corpus of the content analysis based on their quality and universality of the documents. In choosing documents which are already reasonably well designed and offer different approaches to document design, the results of the participant feedback can be generalised. Throughout the study, a measure was taken to avoid priming effects (Gleitman et al., 2011) of the participant during the inspection of the instructions (see Appendix 7). By providing the participants with three out of five chosen documents (see Appendix 6) per user testing, on alternating orders, it was assured that every participant saw the documents in different orders. Therefore, the setup of the study prevents potential bias in opinions since feedback and comparison of previous

documents differ per participant. By not sending the instructions and questions to the participant upfront, it was possible to avoid that they prepare for the type of documents and questions. At the same time, it also allowed the researcher to witness the immediate reactions and test their opinions in a real stress scenario similar to the provision of information in a crisis situation.

The research set up was held exclusively digitally in order to accommodate the rules regarding the COVID-19 situation. On the one hand, digital interviews could have made it more attractive and less stressful for some participants (Nashef, 2020) while this also might have naturally disabled the participation of other people with autism. This could have been the case for example due to unavailability of the technological resources or an increased threshold due to a hesitant opinion towards video calls. Within the responses of the participants, the content itself and their knowledge about the crisis was not the main focus. Instead, it was important to focus on the comprehensibility and potential phrasing issues the participants encountered. Therefore, the findings can be applied to a broader area of documents and do not depend on the reader's English skills. The sub-research question of Study II will be answered by focussing the participants' attention on visual, linguistic, and content-related aspects. The responses to those sub-questions allow conclusions about the demands people with autism have for behavioural instructions.

Participants. The participants were acquired for a cross-sectional study with a clustering according to autism or no autism. The group with autism was composed via a probability sampling in order to represent the realistic likelihood of autistic people viewing the instructions. The neurotypical group was found through purposive sampling to explicitly find people who do not consider themselves as autistic. The comparability of people with and without autism allows differentiation between which ideas and guidelines are specifically autistic and which differences prevail. It also provides insight into the usefulness of autistic design needs for neurotypical perceivers. In total, 19 persons participated in this research which is viewed as sufficient to receive meaningful insights about usability concerns (Nielsen, 2012). 14 of them were autistic and 5 identified as neurotypical (M_{age} = 25.89; age range 18 to 56 years; SD_{age} = 9.19; 47% male, 53% female). All participants reside in Germany or the Netherlands, but not all participants (in both groups) were born in those countries or live in the countries they were born in. Every participant concluded the entire user test and interview without refusing to answer any questions or withdrawing from the study. Furthermore, all

participants answered more extensively than expected in order to convey their perceptions and experiences on their own accord.

Neurodiverse. 14 people participated in the autistic group (M_{age} = 26.86; age range 18 to 56 years; SD_{age} = 10.51; 57% male, 43% female). The autistic group presented a relatively even gender distribution which matches the estimation of autism prevalence in the world but does not represent the current gender bias. This means that commonly autism is perceived as a male condition, although it might as likely be found in women (American Psychological Association (APA), 2013). The autism group also displayed gender diversity as it includes transgender identification. The education level of the participants ranged from school exit without graduation certificate to a PhD degree. Furthermore, the participants exhibited different types of autism as found on the spectrum, such as what used to be referred to as Asperger, but also so-called classic autism. Additionally, the participants required different levels of support in their daily life, ranging from little to substantial. This information shows that the responses are balanced for different levels of education, types of autism, and requirement of support.

Neurotypical. Five neurotypical persons indicated their perception of the documents (M_{age} = 23.2; age range 22 to 25 years; SD_{age} = 1.17; 20% male, 80% female). All of them were gender-conforming and currently obtaining university bachelor's degrees.

4.1.3 Data Analysis. For the data analysis, all interviews have been transcribed, anonymised and the answers relating to the research questions have been extracted. Subsequently, the frequency of such results has been determined and items have been ranked by their importance to most of the participants. This means that aspects which have been mentioned often regarding the same document, on different documents and by various participants were categorised as especially relevant. It was defined which underlying reasons for such difficulties could be pointed out and aspects were grouped based on such underlying reasons. For example, criticism about missing the red thread or the order in which the document should be read, fall under the category "need for structure", but then make up a subpart in which guidance on how to read the document is requested. The category "need for structure" for example entails missing hierarchy and ranking of the importance of information presented.

Through a bottom-up approach, the main suggestions and criticism were identified and sorted into one of the three categories. The responses of the participants either focused on visual, linguistic, or content related aspects. Some categories have subcategories, for example

the visual category can be differentiated between structural aspects and classical design aspects. All categories mention several ways in which documents can be improved to benefit people with autism. Furthermore, it has been established which aspects relate specifically to autistic people and which points would provide general improvement. The findings have then been formulated as guidelines and sorted into categories of do's and don'ts to provide designers and content creators with points they can follow in the future to offer autism-oriented but overall clearer documents.

The data was saturated and provided several aspects upon which the majority of participants agreed. The validity of the answers was assured due to the research approach. The implementation of reader research and a verbal plus-minus approach as well as the usage of probing questions to elicit in-depth responses contributed to saturated responses. The validity of such feedback has been shown before through positive experiences with different communication materials (Boeije, 2010).

4.2 Results

For many autistic people it is difficult to anticipate how the designers imagined a document or program to function and in which order. Trying to understand it can be compared to finding a way through an adventure game, just that it is not played voluntarily and nearly continuously. Instead, in order to identify the focus and determine the clarity of a document it can be beneficial to view a black-and-white version to see the hierarchy and make design decisions afterwards. Furthermore, It can be useful to organise documents like news articles. Mention the newest/most important things first and then add the rest. Thereby, if it is too long it can be shortened going backwards. Additionally, it is important to keep in mind which target group is being addressed. It can be helpful to provide some more general information first, but also options for people that want to learn more things in depth. But those options should not be mixed.

4.2.1 Do’s. The participants expressed their preferences and suggestions especially for the following do’s. This means that they would like designers of instructions to follow these visual, linguistic, and content related guidelines. A complete overview of all preferences can be found in Appendix 8.

Visual. The visual do's, Table 2, entail suggestions for structure and design. The structure category relates to hierarchy, layout choices and alignment, while the design category refers to colours, images or pictograms and visibility of features. The participants found that the usage of many, quite detailed instructions which are either close together or about the same topic can be counterproductive. This stems from a tendency to forget some of the many similar aspects. Additionally, to the suggestions for designers, participants notice that document design sometimes resembled advertisements very much, e.g. the Dutch instructions were compared to Telecom advertisements. Furthermore, they considered the role pictograms were intended to play for the instructions. They identified that pictograms were often unclear and were not able to stand on their own and therefore, did not seem to have the intended use due to potential confusion that it caused. Moreover, they wondered how far pictograms were pre-defined or if it was the personal choice of the designer, especially with regards to international usage of such symbols. Lastly, they strongly expressed that pictures should only be used prominently if they convey relevant information. Otherwise, they recommend refraining from using them as they appear useless and might unnecessarily interfere.

Table 2
Guidelines for autism-friendly visual design

Main Categories	Subcategories	Specific Guidelines
Structure		
	Hierarchy	● Provide guidance (e.g. with numbers) on the order the document should be read in. ● Provide hierarchy in the points according to importance. ● Similar things should be treated equally. E.g. Each information should receive a separate sentence each. ● The most important points should be the first thing to read. The rest can then become smaller.
	Layout	● Keep the document plain and restful to read.

		● Spread out the information instead of clustering it. ● Be consistent with the layout in groupings/boxes. ● Balance in the length of paragraphs/sections. ● Sort information into different blocks. ● Provide a heading so that it is clear what the part is about.
	Alignment	
		● Make sure the design is properly aligned. ● E.g. putting information inside a box, not overlapping.
Design		
	Colours	
		● Colours need to have a purpose. ● Use colours that are easy to distinguish and differentiate. ● Use colours according to the role/relevance of the information.
	Images/Pictograms	
		● Only use pictures prominently if they convey relevant information. ● Use pictures/pictograms to support the textual statement. ● Make sure pictures can be distinguished from each other.
	Legibility	
		● Use proper contrast. ● Use readable font size.

Linguistic. Regarding the linguistic aspects, Table 3, the participants stressed that the document should be comprehensible. It is especially helpful to prepare the reader for what they will find and to assure the reader that this will be doable and not too complicated. Regarding conciseness and focus, it is recommended to keep things simple in order to highlight the relevant points and make those stand out. This also relates to keeping text precise and not using

unnecessary text by, for example, using short chunks of text to provide information. Otherwise, the risk increases that attention gets lost (Grandin & Panek, n.d.). Additionally, information should be condensed so that it can be read and comprehended quickly. For the topic specific information, it is especially important to use common and therefore easily understandable language, for example tissues instead of handkerchiefs. Moreover, many participants pointed out that specific phrasing is necessary to avoid things being taken too literally. This means that phrasings should not be unrealistic, non-precise or inexact. Additionally, things should not be too detailed if not necessary.

Table 3
Guidelines for autism-friendly linguistic design

Main Categories	Specific Guidelines
Comprehensibility	● Prepare the reader what they will encounter.
Conciseness & Focus	● Keep things simple. ● Make it very clear what the most important parts are and what the reader should do. ● Condense information.
Phrasing	● Use short chunks of text to provide information. ● Use common, easily understandable language. ● Be specific with phrasing and refrain from things which can be taken literally.

Content. When it comes to the content of the documents, there are some general suggestions on how to improve the perception, Table 4. One example is to show the source of the document such as governments very clearly and prominently, for example, at the top of the document. In this way, the credibility is established immediately and the reader perceives the document and information presented as more reliable. Another example is to show the relevance of the document especially in newer iterations of the instructions by making it visible

what is new in this document, for example, compared to previous editions. By highlighting the most relevant parts, everyone can quickly and concisely inform themselves. Additionally, it is suggested to provide access to further information in different ways so that people can make use of it according to their preferences. This means that for example phone numbers for more personal interaction should be provided, but also email addresses for people who prefer to avoid such contact, as well as websites with further information and for example QR codes for fast access to the information. Regarding the topic COVID-19, it became relevant for the participants that materials distinguish between different names which the illness and virus might be referred to as well as informing the reader about the harmfulness of the illness. Applying this to other crisis situations, it means that terminology should be addressed and the threat of the crisis should be clearly indicated.

Table 4
Guidelines for autism-friendly content design

Main Categories	Specific Guidelines
Credibility	● Portray the source the document is made by clearly and prominently.
Relevance	● Make visible what is new in this document compared to previous editions.
Referral	● Provide access to further information via different channels.

4.2.2 Don'ts. The participants pointed out a few crucial aspects that they would like designers to avoid for future instructions. A complete overview of all preferences can be found in Appendix 8.

- Do not make them too complex.
- Avoid similarities or the indication of a structure if there is no intention for it.

- Do not use the same picture for different purposes. The expectation is that it always means the same.
- Do not use commands, but reasonable instruction phrasings.

Participants highlighted that similarities can often indicate a structure and if there is no structure intended, this can lead to confusion, especially because it can be hard for people with autism to imagine that there is no intention behind the similarities. They also criticised the usage of the same picture for different purposes as it creates the expectation that it means the same, although it does not. Lastly, the instructions should be phrased in a clear but cooperative way instead of using commands that talk down to people. This might lead the readers to ignore the instructions altogether.

4.2.3 Comparison neurotypical/neurodiverse. The exploratory and indicative comparison of perception differences of neurotypical persons compared to neurodiverse people yielded several relevant results.

Similarities. It clearly shows that autistic people do perceive the instructions differently than neurotypical people, but that neurotypical people indeed appreciate the suggested clarity following the autistic recommendations. It was noticeable that neurotypical people did not identify several errors independently but agreed to proposed adjustments when problems perceived by neurodiverse people had been specified towards them. Other occasions on which neurotypical and neurodiverse people agree are preferences of grouped information and the appreciation of headings as summaries of grouped texts.

Contradictions. At the same time, there were also several aspects which were more often mentioned and experienced by people with autism than by people in the sample without autism. It seems that neurotypical people can make up for missing social information more easily or do not need as much detail to envision social situations as it is the case for people with autism. This might be due to better comprehension and understanding of social behaviour. That can be supported by the reaction regarding the document from China, of which many people with autism appreciated the level of detail and effort of the drawings, while people without autism were not satisfied with the amount of detail provided. The people with autism stressed their liking for clarity in graphics as well as pictograms, while people without autism often found the visuals quite clear and did not have the same need for further information as expressed by people with autism.

Another finding can be illustrated through the reaction towards the document of the United States of America. Both samples observed that the usage of colours seems random and for many people with autism this seemed to contradict the numerical guidance system. It stood out that the effect such a realisation had on people with autism was longer-lasting and more intense than for people without autism. Additionally, people without autism seemed to be able to relate the colour usage to design choices of the person creating the document or suspected that the colours were related to the colour scheme the organisation uses. Furthermore, while autistic people prefer plain designs without many distractions, neurotypical people prefer colourful and attractive design over the alternatives for people with autism, since they interpret those as "plain, clear and boring layouts". To meet the autistic needs, it was recommended by a participant that designers could consider how their design looks after being photocopied. For example, by reviewing the impact the copying has on legibility as well as the effect a black and white version of the document has.

Aside from highly interesting findings, it should be kept in mind that not everyone is aware that they might have autism and can, therefore, not reflect on the different perception. These differences should make us aware of different types of perceptions in the world which require sensible approaches to match the needs of each group. Overall, neurotypical people might not require as precise documents in order to understand them thoroughly, but they do profit from the enhanced quality such documents would bring.

4.3 Conclusion

People with autism did indeed encounter several difficulties with the presented documents. They expressed several likes and dislikes about the instructions which could often be assigned to one of the three categories, visual, linguistic, or content aspects. The participants found many design flaws which could be improved to provide them with easier information retrieval from documents. But they also found several aspects which were already done well in some documents and which they would appreciate to see as a standard for other documents. The most important thing to keep in mind when designing things for people with autism is to keep it short, simple, and according to the relevance of the material.

Furthermore, it stands out that people with autism prefer it very much if the background is not distracting and if documents are designed for hierarchy (Van Bart & Steehouder, 2008).

They also prefer guidance on how the document should be read such as arrows or numbers which indicate the order. Additionally, grouping information and giving the information headings that quickly indicate what the text is about is perceived as beneficial. Moreover, they prefer when pictures are only used according to their relevance and in a clear design, which does not cause confusion compared to the text provided. Visually as well as linguistically, anything that is displayed should be chosen intentionally and convey relevant information as well as be legible and distinguishable from each other. On a content level, the participants asked for concrete and clear explanations about terms that are used to describe elements of the crisis. In this case, for example, distinctions between COVID-19 and the name of the virus. Furthermore, they prefer when credibility and relevance of the document are highlighted and access and referrals to further information are provided. Things they want designers to avoid is making the instructions too complex, using similarities or indications of a structure when there is none, and choosing friendly but clear instructional phrasings instead of commands.

When it comes to comparison of neurotypical and neurodiverse people, it was found that in many cases, autistic people find errors faster and that neurotypical people agree with these flaws if pointed out. They also prefer groupings in texts and understand the usefulness of headings above those boxes. Contradictions relate to how unintentional similarities can be handled, which people with autism find weird and confusing, while neurotypical people try to find an explanation why it was done like that and then continue. Another contradiction is the amount of detail to depict social situations and interactions in images that the groups prefer. While the neurodiverse people found it very clear and enjoyed the demonstration, neurotypical people found it too much and perceived the material as unnecessarily crowded.

The results of Study II with people with autism matches the estimations made in Study I after the inspection of various instructional designs. Regarding the content people with autism do indeed request referral information to other sources so that they can look at websites or contact the source of the instruction for further questions. It was pointed out that many do not only want options for further information which enable them to avoid phone calls but that phone calls can be okay or even preferred if the user has a choice and decides to call as it might be more convenient to clarify questions about the instructions. When it comes to the paragraphs as predicted many autistic people reported that a document might seem overwhelming if it is too full for their liking. They also mentioned that especially when there are no paragraphs or the structure of the paragraphs is not clear, the instruction causes confusion. This means for

example that the order in which the document should be read can cause confusion if not clearly indicated. As mentioned in Study I the participants preferred grouped information according to the topic.

Study II also shows many similarities with the predictions from Study I. The colour choices of the documents were especially liked colours such as blue and white backgrounds and blue white or black writing. Study II found that bright or intense colours are perceived differently than the others but that they also might be disregarded because they do not seem serious or even relevant. An example of this is that the Dutch document was initially perceived as advertisement rather than instructions. With regards to the positioning of the graphics autistic people also agree with the findings of Study I because they point out that in the Canadian document the virus which is used for decorative purposes is distracting and even annoying rather than a good way to attract attention. The design of the Chinese document was liked as supposed in Study I due to their complete visualisation and supportive nature. The pictograms were perceived as even worse than stated in the previous study. Many people with autism found them to be unclear, unnecessary, and not able to stand alone. The heuristic principles were not explicitly addressed in Study II but elements such as missing reading flow in situations in which the expectations of the participants were not met by the document design. Additionally, legibility problems due to small font sizes were frequently pointed out as well as instructions which were perceived as too full and unstructured. As assumed in Study I, the participants found that in many cases the relevant information did not stand out on the documents or could not be found easily which resulted in an aversion of the people with autism to continue using the documents.

Lastly, the expectations regarding the use of language as described in Study I was not by Study II. This is due to the fact that rhetoric devices were not mentioned by the participants and the sentence length was not a focus point either. Instead people with autism focused very much on typos made in the documents as well as unclarity of sentences or the usage of unnecessarily many words to describe the topic. This shows that the effects of language as examined in Study I were not recognised in such detail during the user tests and therefore have not been assessed while the participants of Study II focused on other linguistic aspects instead.

Overall, the findings in Study II match the elaborations and estimations of Study I to a great extent but also add more far-reaching focus points, preferences, and aversions for document design.

The findings of this Study II are also in line with five design do's and respective don'ts for users on the autistic spectrum when designing for autistic accessibility as developed by Pun (2016). Just like their study, this research also found that autistic people prefer simple and intentionally chosen colours over bright colours which are used to attract attention to the document (point 1). This means that documents should not use colours such as pink, just to get noticed, but could make use of calmer colours such as blue instead. Furthermore, it was also found that texts should be written with less complicated phrasings as well as be to the point and not contain unnecessary information (point 2). Participants also preferred and requested short sentences which only contain a few concise terms (point 3). In this research the participants preferred a clear form such as bullet points. Study II did not test buttons (point 4) but also found that for autistic people, a clear call to action and instructions is important. Especially in situations where the document refers to other sources of information, it was requested that the focus of the instruction and how the reader should act are central. The last aspect which was mentioned in the study by Pun (2016) and confirmed in this study is the request for a simple and consistent layout (point 5). In this research, simplicity was valued over abstract choices and consistency as well as clarity regarding the choices in the form of, for example, a legend was suggested. Additionally, the implementation of hierarchy within documents was largely favoured to establish the most important information any reader should pay attention to. In addition to confirming the rules as proposed by Pun (2016), this research also determined several other do's related to different categories of document design and some don'ts designers should avoid.

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Despite the generalisation of preferences based on the frequency and consistency with which those were mentioned by the participants which led to the guidelines, autism is very diverse and so are the people with autism. It is important to remember that people with autism still have personal preferences and aversions which do not necessarily relate to their condition but are an expression of their individuality. This means that instructions which are meant for many people will have to make trade-offs to meet the general needs, while instructions on smaller scales could be tailored even more to the individual preferences of the autists they are intended for.

5 - Discussion

5.1 Main findings

This study addressed the research question “Which demands do people with autism have for behavioural instructions?”. Additionally, it focussed on two sub-questions. Study I, the content analysis, answered the question “To what extent do behavioural instructions regarding COVID-19 meet design criteria and match autistic needs?” and Study II, the comparative research, provides insight into the question “Which aspects of instructions are required by people with autism?”.

5.1.1 Study I. The first study found that several COVID-19 instructions do not adhere to design guidelines and thereby especially do not meet the needs of autistic people. This happened in different aspects such as content related, where referrals to further information sources were not offered consistently, and restrictedly, for example where such referrals were offered only via phone and therefore not addressing people with autism. Furthermore, paragraphs were long and the reading order was not clear. The design aspects that were especially problematic were unclear usage of colour, for example too much of it, or colours which do not convey the impression that it contains serious and relevant information.

Additionally, the positioning of graphics was often intended to catch attention without transferring any information and therefore was not useful. Pictograms were, despite good intentions, often too small and it was unclear which information they were supposed to communicate. Heuristic principles were often neglected e.g. by providing only one way of accessing information or designs which do not match the anticipation of the viewer. Furthermore, linguistic aspects were the usage of rhetorical devices which did add reading flow but were not executed consistently. The sentences were often too long and there were too many sentences which made comprehension more difficult. Overall, behavioural instructions regarding COVID-19 do not yet meet design criteria and match autistic needs. Most documents exhibited some understanding of the needs of the reader, but all could benefit from streamlined guidelines and further considerations how the crisis instructions might be perceived.

5.1.2 Study II. The second study found out which aspects of document design people that do have autism find especially relevant. Several things designers should do in the categories visual, linguistic, and content, as well as some things designers should absolutely

avoid were defined. The visual do's related especially to structure such as providing hierarchy and guidance and establishing which things are important. It also focuses on restful layout's on which information is grouped but spread out as well as colours having a purpose. The usage of pictures is restricted to supporting textual statements and prominent positions only to convey relevant information. Generally, contrast and size should be chosen to ensure legibility. Linguistic aspects are keeping information simple and focused as well as using short chunks of text to provide information in common and easily understandable language. The phrasing should be specific and not make use of sentences which can be taken literally and thereby misinterpreted. Additionally, the reader should be informed about what they will encounter, so that they can read it with the correct mindset. Related to content, credibility and relevance of the document need to be established to gain acceptance of the instructions. This can be done by portraying the source of the document, clearly highlighting changes, and new information, as well as referring to access to further information. The things designers should absolutely avoid are making the documents too complex, using similarities or indications of structure if there is no need for it, using the same things such as images for different purposes, and approaching the reader with commanding tone.

5.1.3 Connection between the studies. The second study built upon the first by verifying the predicted shortcomings as identified in Study I and enriching it with further suggestions on how to improve instructions according to autistic preferences. The responses by the autistic participants did confirm the findings of the first study and match the few other sources which provided suggestions on how to create document design for autistic people. The autistic views did differ from "typical" views to some extent, but can in most cases be reconciled, except for the preferred level of design to attract attention to the material. Both studies allow the research question to be answered by saying that autistic people most importantly have demanded that instructions are purposeful, clearly structured, and not overly complicated.

5.2 Theoretical implications & contribution

The findings of the study match the premises of the theoretical framework and conceptualisation. Several participants mentioned that the importance of a document plays a crucial role when determining whether or not to proceed with the inspection of the instructions.

They stress that the perceived relevance of the information presented as well as the credibility of the document and the source of the document help them to assess the document. Next, they evaluated visual aspects such as the structure and the design of the instructions in order to determine if they liked the style and if the content of the instructions matches the presentation. Additionally, they explained difficulties and preferences regarding the use of instructional documents and gave suggestions to improve their user experience. Lastly, they evaluated completeness and comprehension of linguistic aspects and relation to the content to assess the overall judgment of the document. Their judgment resulted in the choice if they would or would not consider the information provided and how likely they would act upon the presented content. Overall, criticism, preferences and suggestions were grouped into visual, linguistic, and content related design expectations and phrased as guidelines with do's and don’ts for designers and content producers.

During the research it was mentioned that some people do not know if they might have autism. Even more, people possess certain traits which are frequent in autists but which also exist separately as distinct conditions (London, 2007). This shows that for many more people improvements of documents in an autism-oriented manner could be largely beneficial. Additionally, it should be kept in mind that beyond the conceptualisation of neurotypical and neurodiverse, people still have their personal preferences which means that some concerns are more or less troubling for some than for others.

The theoretical merits of this research lie especially in establishing and providing knowledge about the effects of autism on design choices which is scarce so far. The application of research is aimed at designers which will then make improvements that are noticeable and beneficial for the target group. Additionally, it leads to people being sufficiently informed about things which are potentially dangerous for them. Studies regarding COVID-19 are novel due to the recency of the crisis and further knowledge can contribute to improvements throughout the continuation of the crisis. Moreover, the comparison between neurotypical and neurodiverse people provides insights into general document design and improvements which aid accessibility and inclusion through instructions.

5.3 Practical implications & recommendations

The practical implications and recommendations to remember from this research are the guidelines mentioned in the results regarding visual, linguistic, and content aspects for document design. The results should lead designers and content creators to incorporate the findings in their future work. Another takeaway are those areas in which these findings can benefit many people in their comprehension of crucial information. The improved documents will not only benefit people with autism but can also provide improvement for people with visual or cognitive impairment or those who do not master the language of the document. This shows that such improvement and conscious usage of the guidelines is crucial and highly beneficial in many areas.

Application possibilities can be found in any area where information is provided in written form. Besides the improvement of documents to communicate crisis behaviours, the guidelines can also be used for the daily improvement of posters. This relates to governmental instructions but also to instructions from, for example, research institutions, financial companies, and other industries. The findings could be applied for internal as well as external communication and information in companies. They could also be used for the promotion of new products as well as clearer instructions for usage and assembling of such products. Moreover, potentially combined with further research, these guidelines can also be adapted towards instructions used in various situations such as education and correspondence on financial and juridical matters like bills and contracts.

Furthermore, an implication this study provides and which should be highlighted is that the skills of autistic people such as being attentive to detail and being able to spot errors faster than people without autism should be appreciated and incorporated in the world more than currently done. The research does not suggest in any way that autistic people would not be able to cope with instructions in the current form but stresses that in regard to a more inclusive and accessible society preferences and needs of people with autism should be considered more. This contributes to clearer information provision and reduced stress factors for fellow citizens at no expense for the Neurotypical citizens.

5.4 Limitations

The study made use of rather standardised research approaches, to address an important and currently under-exposed topic with the secluded target group as well as a highly current topic with results that are applicable to many other situations. Therefore, the research is highly relevant and novel.

5.4.1 Methods and instruments. Due to the digital set up of the study, the sampling of participants was impacted. For example, a non-explicit but unavoidable exclusion of potential participants took place for people who fear video calls as they refrained from participating in the study. At the same time, this aspect also poses the strength that this version enables people with an aversion against personal contact to participate in a study. The digital set up of the study allowed more flexibility when establishing and conducting the interviews and allowed people to participate regardless of their residence. However, the flexibility might create some difficulties for autistic people due to more uncertainty than they might prefer. Another limitation of this study is that illiterate, dyslexic, or mute people did not participate since they might not have been aware about the existence of the study and these people were not explicitly invited to join the study. Therefore, in order to provide a more complete sample of the target group, with all types of diagnosable autism should be included in a revision of this study.

5.4.2 Study execution. Due to the adjusted method during the COVID-19 situation, several participants encountered some technical difficulties such as delay in the connection, frozen screens, or interrupted calls. This might have increased the stress participants felt and therefore made the situation even more realistic, but it also indicates that the study was impacted by the adapted set up and the results would benefit from verification in an analogue setting. It is, however, important to note that despite the technical difficulties, all participants completed the user tests and interviews. Furthermore, they explicitly expressed a high intrinsic motivation and their perceived responsibility to participate in this study in order to stand up for other people with autism and to take a chance to receive attention for their needs. The feedback of the participants was incredibly positive. Another limitation which was also impacted by the COVID-19 situation and respective measurements did not allow personal meetings in order to conduct the research, therefore, the sampling was asking more of potential participants then in person meetings might have. This is based upon the fact that interested people had to reach out to the researcher and additionally participate via video calling which requires much surmounting. Lastly, presenting different documents in a different order to prevent any bias

was successful, since participants did compare their impressions to things they had previously seen. Due to the set-up, this means that all participants had seen the materials in different orders and therefore made the results more generalisable.

5.5 Future research

Based on this study a lot of potential future research topics have been identified. Many of them were specifically mentioned by the participants who have the feeling that these aspects are not yet considered. The research suggestions can be sorted into four categories.

5.5.1 The extension and application of the findings in other circumstances. This category relates to ways in which the research could be extended to yield more detailed requirements for some of the guidelines as well as application possibilities for other areas of daily life.

- A verification of the results of this study via in-person research to remove the limitation of selection via video calling.
- Preferences regarding sentence lengths and the amount of text provided per instruction.
- Preferences for certain fonts and the assurance of good legibility.
- Application possibilities of the guidelines to (scientific) articles and literature.
- Application possibilities of the guidelines in classrooms (e.g. for exam designs and layout of handouts and exercises).
- Application possibilities of the guidelines for invoices and contracts.

5.5.2 Helping people with autism or different conditions. This category aims at focusing more research on autistic perceptions and conducting similar research for the needs of people with different types of conditions.

- The applicability of this research for different conditions such as Attention Deficit Disorder (ADD) and Attention Deficit Hyperactivity Disorder (ADHD), but also illiteracy or colour-blindness.
- The usage of pictograms and illustrations to provide information without requiring advanced reading skills.
- Differences in autistic perception based on different ages of the participants.

- Gender differences in autistic perception.
- More concrete differences between neurotypical and neurodiverse perceptions and potential compromises.
- The effects of colour as a guidance system to provide hierarchy and structure in documents for people with autism.
- Determining the most suitable order and positioning of information boxes according to reading preferences.
- The effect of respective attention curves on information reception and retention and consequently on document design.
- Differences in perception based on colour usage and positioning of document components.

5.5.3 Document design. This entails study suggestions to research several aspects of document design itself.

- Comparison of document design and advertisements regarding similarities, differences, and potential overlap.
- The effects of slogans as motivational aspects on behavioural instructions.
- How do the findings differ if tested on different types of documents, how much difference is there in the perception?

5.5.4 Other related research. This category summarises other potentially interesting investigations which came up during the research.

- How inclined are people to follow rules based on instructional design?
- The effect of usage of national colours (e.g. blue, white, red, or orange for the Netherlands, or black, red, gold/yellow for German documents) on perception.
- Preferences of font types dependent on familiarity with different styles per region and common exposure (e.g. New York Times).
- Situations causing the feeling to be forced to follow instructions and the actual behavioural change exhibited.

5.6 Conclusion

The study highlights that the needs or preferences of neurotypical people do not differ as much from autistic people as stereotyped so far. This means that the autistic wishes and requirements should be considered and standardised in order to improve instructions for many people. Additionally, the capabilities of autistic people in spotting errors and providing clear and critical feedback on instructions should be valued more. While autistic people can benefit the world, which is designed for neurotypicals, there are also many easy solutions to enable small changes which make the world more inviting towards neurodiverse people. These changes, for example guidelines for instructions as proposed in this research, should become the new standard that instructional designs rely on to make the world more accessible. A participant said: “Understanding Autism is like learning about a different culture and language. Only if both parties are aware of the differences, can difficulties, miscommunication be overcome.”. This is something everyone should be open to experiencing.

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Appendices

Appendix 1 - BMS Ethics Committee Approval (shortened)

Dear researcher,

This is a notification from the BMS Ethics Committee concerning the web application form for the ethical review of research projects.

Requestnr. :	200569
Title :	Guidelines for instructional design for people with autism
Date of application :	2020-05-03
Researcher :	Probst, A.K.
Supervisor :	Jong, M.D.T. de
Commission :	Galetzka, M.
Usage of SONA :	Y

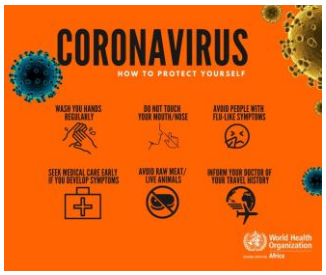
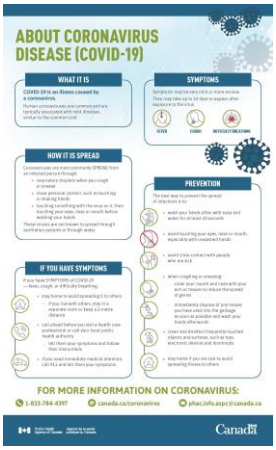
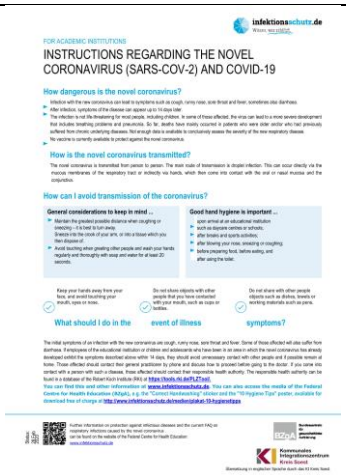
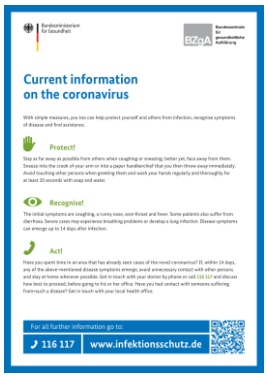
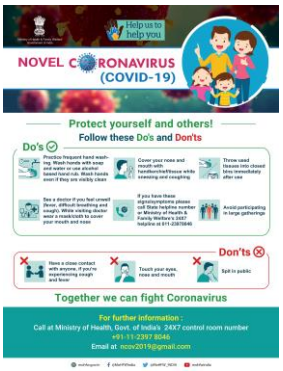
Your research has been approved by the Ethics Committee.

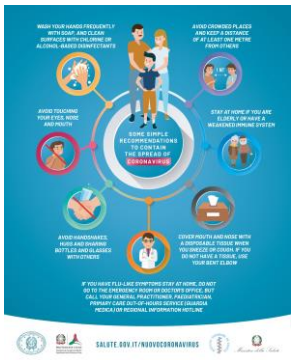
The ethical committee has assessed the ethical aspects of your research project. On the basis of the information you provided, the committee does not have any ethical concerns regarding this research project.

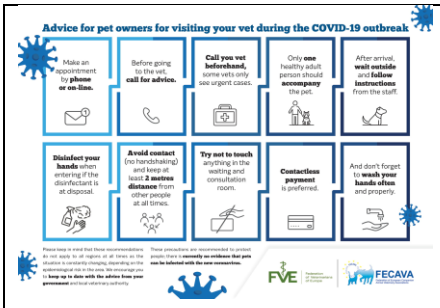
Appendix 2 - Mandatory literature study log in enclosures

Date	Source? Database (db), Book (b), Internet (url)	Search terms and strategies (Search profile incl. Boolean operators)	How many hits (how many relevant)	Related terms/authors	Notes
25-02	Google.com	Instructional Design & Accessibility & Mental Disorder	52.900.000 (first 4 hits interesting)		Very specific results, not all fitting. Maybe look for topics more separately.
25-02	Scopus (db)	"instructional design" AND accessibility	79 – sorted on relevance – some useful, but lot of noise		
25-02	Google Scholar	"instructional design" accessibility "Mental Disorder"	258 hits, and a lot higher proportion of relevant results 200 between 2009 & 2020		
25-02	Web of Science	Accessibility AND "Mental Disorder"	24 hits, about 4 seem useful		Maybe it helps to look for specific mental health disorders

Appendix 3 - Corpus Documents

		
WHO Africa	Australia	Netherlands – Autism Association
		
Canada	China	Germany – Academic Institutions
		

France	Germany	India
		
Israel	Italy	Japan
		
Kyrgyzstan	The Netherlands	Spain
		
Sweden	United Kingdom	United States

		
Europe - FECAVA	WHO	

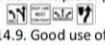
Appendix 4 - Codebook Study I

	Main code	Subcodes	Definition	Examples
Form Codes	1. Document Name	1.1 Africa WHO 1.2 Australia 1.3 Autism 1.4 Canada 1.5 China 1.6 Education 1.7 France 1.8 Germany 1.9 India 1.10 Israel 1.11 Italy 1.12 Japan 1.13 Kyrgyzstan 1.14 Netherlands 1.15 Spain 1.16 Sweden 1.17 United Kingdom 1.18 United States 1.19 Vet 1.20 WHO	The name of the document is based on the country or audience the instructions or information on Coronavirus (Covid-19) are provided for.	"Coronavirus Germany" entails information about the coronavirus which hold for Germany. "Coronavirus Autism" entails information about the coronavirus which are relevant for people with affiliation to autism.
	2. Publication Type	2.1 Social Media File 2.2 Poster 2.3 Information Leaflet 2.4 Print Resource	The intended publication version, social media, infographic, or poster mentioned on the page where it was retrieved.	Social Media File or infographic
	3. Publication Date	3.1 February 2020 3.2 March 2020 3.3 April 2020 3.4 May 2020	When it was published (the relation to the progression of the crisis)	28 February 2020 or March 31, 2020
	4. Publication Location	4.1 WHO Website 4.2 Government Website 4.3 Health Ministry Website (provided in English)	Information where the document was retrieved	"Website Israelian Ministry of Health"
		4.4 Instagram Dutch Autism Association 4.5 News page translating Government Information to English 4.6 Website Federation of European Companion Animal Veterinary Associations		
	5. Publication Focus	5.1 Protect 5.1.1 Yourself 5.1.2 Yourself and others 5.2 Information About Coronavirus (Covid-19) 5.3 Instructions 5.3.1 Wash hands 5.3.2 Stay safe at work 5.3.3 Isolation 5.3.4 Visiting the vet 5.4 Prevention of Coronavirus spread	The message that is in the focus of the document.	"Coronavirus How to protect yourself"
	6. Intended Audience	6.1 General public 6.2 Travellers 6.3 People with affiliations to Autism association 6.4 Employees 6.5 Academics 6.6 People with mild cases of Covid-19 6.7 Pet owners	The people which are expected to view the document.	"Travellers" "General public" "Africans"
	7. Actors Mentioned	7.1 Department / Ministry of (Public) Health 7.2 Infection Protection Agency 7.3 Federal Centre for Health Education 7.4 Municipal Integration Centre	The organisations the document refers to.	"Logo of a government" "Logo of a health organisation"

		7.5 Government 7.6 Civil Protection Department 7.7 Higher Institute of Health 7.8 Federation of Veterinarians of Europe 7.9 Federation of European Companion Animal Veterinary Associations 7.10 United Nations 7.11 WHO		
	8. Referral	8.1 (Search term to) Website 8.2 Information Phone number 8.3 Email-address 8.4 QR-Code 8.5 Social Media Accounts 8.6 Emergency Phone number 8.7 Hashtag	Additional information the document refers to.	Links, QR codes
	9. Language	9.1 Native Language 9.2 Translated to English	Language used on the document. Is it in the native language in the country or a translation to make it more accessible for people?	Kyrgyzstan has the text in its own language (and symbols)
Content codes - Design -	10. Colour	10. 1 Background Colour 10.1.1 Red 10.1 2 Orange 10.1.3 Yellow 10.1.4 Green 10.1.5 Blue 10.1.6 Purple 10.1.7 Pink 10.1.8 White 10.1.9 Brown 10.1.10 Grey 10.2 Font Colour	1. Colours used in the background of the document. This can be larger as well as smaller areas. It is relevant that images or text in other colours can have it as a background or are highlighted by it. 2. Colours used as font of the document	1. The document background is bright orange. 2. The font is black and different types of blue.

		10.2.1 Red 10.2 2 Orange 10.2.3 Yellow 10.2.4 Green 10.2.5 Blue 10.2.6 Pink 10.2.7 White 10.2.8 Brown 10.2.9 Grey 10.2.10 Black		
	11. Illustrations/Images 	11.1 Size 11.1.1 Very small 11.1.2 Small 11.1.3 Medium 11.1.4 Large 11.1.5 Very large 11.2 Positioning 11.2.1 Foreground 11.2.2 Background 11.2.3 Overlapping 11.2.4 Decorative 11.2.5 Informative	1. The size illustrations and images (not pictograms) take up of the poster. This could be photographs or drawings with much detail. 2. The role the graphics and drawings play on the poster. Very small (~1/120th of the document) Small (~1/40th of the document) Medium (~1/20th of the document) Large (~1/9th of the document) Very large (~1/3rd of the document)	1. A sketch of the Covid-19 Virus takes up around 1/9th of the document. 2. The sketch of the Covid-19 virus is located in the foreground, overlaps with some text, and is used for decorative purposes.
	12. Text	12.1 Size 12.1.1 Very small 12.1.2 Small 12.1.3 Medium 12.1.4 Large 12.2 Positioning 12.2.1 Grouped in blocks 12.2.2 Cramped together 12.2.3 List format	1. The size the texts take up of the poster. 2. The position and style the text has on the poster. Very small (~1/120th of the document) Small (~1/40th of the document) Medium (~1/20th of the document) Large (~1/9th of the document)	1. The text takes up around 1/3rd of the document. 2. The text is provided in list format and is cramped together.

	13. Symbols / Pictograms 	13.1 Wash your hands 13.2 Don't touch your face 13.3 Recognise Symptoms 13.4 Get Medical help 13.5 Stay home & Isolate 13.6 Cover cough & sneezes 13.7 Opportunities through Technology 13.8 Avoid Contact 13.9 Cleanliness 13.10 Modes of Transportation 13.11 Encouraged Behaviours 13.12 Instructions	The behavioural instruction provided/supported by pictograms. This means figures visualising one actions without much additional detail.	1. Hands 2. Hands close to face 3. Nose, Lung 4. Doctors bag, Cross symbol 5. House, Separation line, Elderly 6. Elbow, Mask, Tissues, Handkerchief 7. Phone, Laptop, Debit card 8. Distanced figures, Several figures 9. Soap, Tissues, Trash bin 10. Plane, Walking, Car 11. Veggies, Sporty person, Open window 12. Check (check symbol), Closed (lock), No (x)
	14. Heuristic Principles neglected	14.1 Legibility Can you read this? Or is this better? Perhaps you like me? 14.2 Similarity causes confusion  14.3 Top down processing  14.4 Redundancy Gain  14.5 Minimise information access cost 	Selection of Wickens Principles for design when neglected. 1. Not everything is legible. 2. Unnecessarily similar features cause confusion. 3. Designs don't match the expectation of the viewer. 4. Information is not provided in more than one version. 5. Important information cannot be viewed easily. 6. Similar information is not close together visually. 7. The design does not look familiar and does not match common designs or experience of the reader. 8. There is no guidance while reading so the user can predict what to do next	1. The text is too small and the contrast of colours prevents legibility. 2. The same symbol is used for different purposes. 3. The order in which information is presented does not makes sense. 4. The check symbol is not in green to reinforce the message 5. It is not clear which information is most important. 6. It is not clear how the information are grouped. 7. The design does not follow a familiar format. 8. The user does not know in which order to read the text. 9. The text is well legible, the symbols are clear, the order makes sense...

		14.6 Proximity compatibility principle  14.7 Principle of consistency  14.8 Principle of predictive aiding  14.9. Good use of the Heuristics 	9. The above mentioned heuristics are adhered to.	
	15. Gestalt Principles neglected	15.1 Law of Simplicity  15.2 Law of Similarity  15.3 Law of Symmetry  15.4 Law of Common Fate  15.5 Law of Closure  15.6 Good use of Gestalt Laws 	Selection of the Gestalt principles when neglected. 1. There is no appealing amount of information, structure, orderliness and white. 2. Elements that seem alike are not grouped. 3. There is no symmetry in the layout. 4. Things which are moving in the same direction are not designed as a unit. 5. Units are not separated. 6. The above mentioned Gestalt Laws are adhered to.	1. There is not enough white space used. 2. Components with the same colour, texture, shape, direction, dimension etc. are not meant to belong together. 3. Information is not arranged symmetrically. 4. Arrows do not support the reading experience. 5. Lines are not used to close of different units. 6. The document has a lot of white space; the categories are clearly visible and images support the understanding of the text.
	16. Other Remarkable Features	16.1 Symbolism of Design 16.2 Direction of Writing	1. The design symbolises something beyond providing information.	1. The layout of the information resembles the shape of the virus.

		16.3 Visibility of Publication Date	2. The writing style differs from the typical western direction. 3. The publication date is shown on the document to indicate the contemporariness.	2. The document counts from right to left. 3. The document was published on "April 13th, 2020"
Content codes - Language -	17. Length of sentences	17.1 Short sentences 17. 2 Medium sentences 17.3 Long sentences	The length of sentences in the documents. Short sentences (< 15 words) Medium sentences (15-25 words) Long sentences (>25 words)	The sentence is short, followed by several long sentences.
	18. Style of Document	18.1 Information overload 18.2 Paragraphs	1. There are more than 7 +/- 2 chunks of information provided 2. Paragraphs used in the text	1. The document gives 6 clear points of attention. 2. Separate paragraphs about Protect, Recognise, Action
	19. Wording	19.1 Colloquialisms 19.2 Phrases 19.3 Frequent usage of same words	1. Non formal language 2. Expressions used in the document 3. Same (non-functional) word used 5x or more times in the same text	1. Don't, Ain't, gonna 2. "Get in touch with" 3. "Disease"
	20. Rhetorical Devices	20.1 Assonances & Alliterations 20.2 Parallelism 20.3 Tropes 20.4 Tricolon	1. Same letter or sound at the beginning of close words. 2. Similar grammar structure 3. Usage of terminology in a different context 4. A series of three words	1. "Three C's" 2. "14 rules for 14 days" 3. "Measures to combat coronavirus" 4. "Eyes, nose or mouth"
	21. Other Remarkable Features	21.1 Slogan 21.2 Typos 21.3 Time frame	1. Memorable phrases used to enforce the message 2. Typing errors which can cause misunderstandings. 3. Information about how long the regulations presented last.	1. "Stop the spread" 2. "Soup" instead of soap. 3. "Up to and including [date]"

Appendix 5 - Extensive Results Study I

	Main code	**Results**
Form Codes	1. Document Name	The instructions were all from different countries from various continents. 3 of the instructions were especially from organisations such as an autism association or academic institutions. This way various approaches to instructional design could be examined.
	2. Publication Type	The instructions were most often presented as posters, in some cases as print resources and rarely as social media posts or information leaflets. The type of publication matters, as autistic people might prefer to receive their information digitally to assess them in more detail in the comfort of their own home, rather than in a crowded and potentially overwhelming setting. Therefore, the medium might impact the information autistic people view and retain.
	3. Publication Date	Most documents were published in March followed by publications in April. 1 document was published in February already and another one in May. For 5 documents their publication moment could not be determined, neither on the document itself nor on the websites it was retrieved from. The publication date provides insight into the progress of the pandemic at the time and therefore, the measures which were suggested.
	4. Publication Location	Most documents were published on the health ministry website or the government page, which might in some cases belong together. Two documents were provided by the WHO and one document each were published on the Instagram page of the Dutch Autism Organisation, A news page translating governmental information and the website of the European companion animal veterinary. It should also be considered, that in some cases the publication location is a translated version of the website to off information in other languages than the countries, while in other countries an English website is the default option. The publication location indicates how easily and purposefully information is made accessible.
	5. Publication Focus	Instructions often aimed for a prevention if the spread of the virus. Next, they encouraged the protection of oneself and others as well as different types of instructions such as staying at home or washing hands. The documents were also sometimes meant to inform the reader or in a specific case, addressed pet owners

		who aim to visit the vet. The focus is especially relevant for autistic readers, as it shows early on, what the information is about and enables the assessment if it is worth to spend time on looking at the documents.
	6. Intended Audience	The instructions most often addressed the general public with the information. Some documents addressed specifically travellers, people with affiliations to autism associations, employees, academics, pet owners or even people with mild cases of COVID-19. The intended audience invited the reader to determine how applicable the document is for them. If the audience is not defined it is meant for the general audience, which also means that it should be accessible for the (entire) population. Therefore, autistic people should also be addressed.
	7. Actors Mentioned	Half of the documents mentioned the department or ministry of (public) health. And about a quarter referred to the government of the country. Incidentally, other health related organisations of the countries were mentioned or it was referred to the organisation providing the information. The provision with the actors that contributed to the document or can be contacted in case of doubt enable autistic readers to place the relevance and credibility of the document when reading the information.
	8. Referral	Most documents referred to websites with further information. Some documents even referred to several websites. Otherwise, phone numbers, email addresses or QR-Codes were offered. Incidentally, Social media accounts or Emergency phone numbers were provided. Some instructions did not refer to any source for further information. These were generally social media contents, so it is likely that referrals could be found in a different location than the document. It is crucial to consider that people with autism might not enjoy phone calls and that the provision of different information sources is largely beneficial to improve accessibility. Also, it was found that providing several different websites can be counterproductive as it lacks coherence and can be confusing. Instead it might be beneficial to connect the information on one website for clearer hierarchy and structure of the information.
	9. Language	The majority of instructions was provided in a, translated English version. Some documents were written in the native language, which can still be English in some cases but can also be any other language. In few cases, the documents provided the information in both, the native as well as the translated version simultaneously. While it is generally appreciated that information is provided in English as well, it is sometimes

		difficult to view both information at the same time and can cause confusion. Additionally, the fact that an autistic reader knows that the text is translated can impact how much a linguistic error is criticised or thought about. This is due to the fact that autistic people have the tendency to want to understand why things are done as they are.
Content codes - Design -	10. Colour	In most cases (parts of) the background were blue, followed by white. These colours have a calming effect and can be considered neutral from an autistic view. Especially the usage of white-space offers relaxation and can help declutter a document. Sometimes the background colours orange and green were chosen. These can create a feeling of urgency or a relation to health. On occasion, the colours yellow, pink, brown and grey were used in the background. They can be viewed as indicating danger, attracting attention as well as neutral. Overall, with colour choices it is crucial to keep in mind that bright colour can be perceived as over the top by autists and that they might prefer simplistic, not attention seeking designs. The font colours were most often, blue, white and black. These neutral and relatively moderate colours are also autism friendly, since they enable viewing the documents with little distraction. In cases where bright colours such as pink or red were used, the effect might be distracting or confusing for autistic readers. If very bright colours are chosen for such a document, they might be disregarded by autists as irrelevant or advertisement instead of considering the information provided.
	11. Illustrations/Images	Illustrations were frequently used to display related content on the instructions. They were often displayed in medium sizes and might therefore not be completely or visible in detail. In many cases the images were placed in the foreground, although the image was not that relevant and, in many cases, rather decorative. For autistic people this can be perceived as a distraction which causes loss of focus or confusion during the usage of the instructions. This is especially problematic if the image does not provide any relevant information but only has the purpose to attract attention. Especially instructions that show images with clear social situations can be beneficial for people with autism as they paint a picture of the situation in which the instructions are applied.
	12. Text	The font size of the text was often small which contributed to legibility problems. The size is critical, as information which are in smaller sizes are generally viewed as less relevant and therefore, might be neglected when skimming the instructions.

		This means that for people which might lose patience while reading the instructions it is crucial to choose the font size according to the hierarchy or information relevance. Most often information was presented in list format such as bullet points, which is very beneficial for autistic people as it enables a quick overview about relevant aspects without complicated sentences. Also, information was frequently grouped in blocks to keep relevant information together, which contributes to a clear overview about the topic since parts that belong together are grouped together. Both options are highly preferable over cramping information together just because there is some space available. Such cramping can be confusing to autistic people as they intent behind such a choice is not obvious.
	13. Symbols / Pictograms	Many different pictograms were used on various instructions. Generally, they tried to encourage hygienic behaviours such as using tissues while sneezing and to follow the rules such as keeping distance and staying home. The advantage of pictograms is that they provide visual information in a very condensed form and can therefore communicate relevant information quickly. A downside is that especially for autistic people the pictograms are unclear and not concrete enough. For example, when very similar designs are used or the same pictogram is used for different information. Unfortunately, it is very easy to cause confusion by misusing pictograms and therefore they might not be liked by autistic people as much.
	14. Heuristic Principles neglected	The heuristic design principles determine how well and user-friendly the design choices were. In many cases the legibility of a document was neglected for example by using colours with too little contrast or choosing a size which is too small. As mentioned above, this can lead to information being overlooked or ignored by (autistic) viewers. On several occasions choices were made where designs were unnecessarily similar, which causes confusion and is not beneficial for the usage of the instructions. Next, frequently, the expectation of the viewer did not match the previously built expectation, which can also lead to confusion or aversion while using the document. Often, information was not presented in different ways, to increase the likelihood that information can be understood. That means for example, that the information could be textual and via images, so that the intention still comes across even when the text cannot be comprehended. It was also often neglected to provide the reader with supportive, reinforcing information which reduces

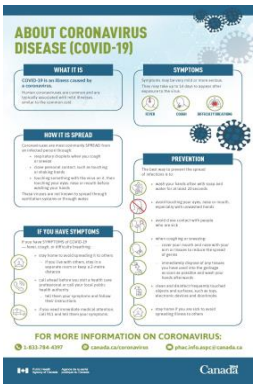
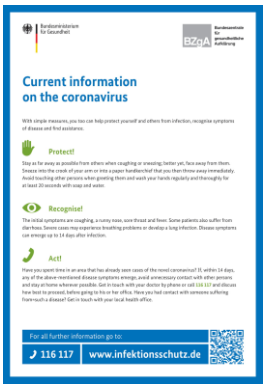
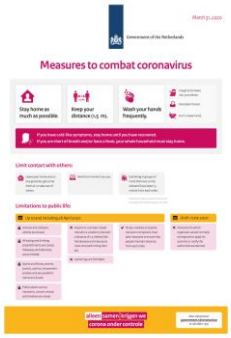
		the effort the reader has to understand the information. Most documents did well when it came to providing information which belonged together, in order to enable understanding, close to each other. Also, it was often well done to be relatively consistent with design choices throughout the instruction. Both aspects show, that the understanding of documents can be improved if such principles are put into practise sufficiently. In turn, several instructions missed support and guidance about what to expect in the following part of a document, which could also lead to confusion and mismatched expectations. But there were also many cases were the heuristic principles were generally well applied and were therefore beneficial for the understanding of the instructions. All those principles can be related to autistic needs but are also highly relevant for any neurotypical user.
	15. Gestalt Principles neglected	The Gestalt principles especially focus on the simplicity of the design choices. Some of them overlap with the heuristics mentioned above and are therefore omitted here. The law of simplicity aims at a simplicity of the design, which can be especially positive for autism-friendly design, as this especially aims for the usage of relevant design aspects. The law of similarity entails that similar elements are placed together, which can help to group information together which is related. The law of symmetry is relevant, as it improves the structure and purposefulness of document design. For autistic people it can be helpful to provide symmetry as a way of sensemaking and thereby to provide ease while looking at the document. Document elements which are seemingly moving in the same direction are grouped together to provide a coherent design. This can also contribute to a calm and purposeful design of the instructions. The law of closure focuses on how things which seem to belong together are placed even if parts in between are missing. Usually the brain is able to connect how things belong together, but it can lead to confusion and aversion of the document when the closure cannot be achieved. Also for this principle, many instructions were already well designed and can therefore already be beneficial for the reader but could nonetheless profit from further improvements.
	16. Other Remarkable Features	In some cases, the design itself symbolised something else, which can be a way to attract attention to a document in an unobtrusive manner, if done well. If not, this can also be perceived as unnecessary and potentially distracting. The ways of writing which deviate from the western way people here are

		used to, can also lead to astonishment and potentially confusion, e.g. if the words are symbols or the text is written from right to left. But, it should also be taken into account that the way of writing is country specific and therefore, might be something to consider when providing translations, but should not be a reason to ignore instructions, even if the usage seems a bit counter intuitive at first. Furthermore, the visibility of the publication date is currently rare, although largely beneficial as it provides the reader with information about how up to date and how applicable the instructions are. This can be especially interesting for people with autism who might like to assess the novelty of the information or can profit from information about the timeframe the information is offered in.
Content codes - *Language* -	17. Length of sentences	As for the length of sentences, some documents stand out, which use a lot of sentences. Hereby, it is crucial to separate between the general length of sentences contrasted with the quantity of sentences used to understand the effect of the sentences. Many short sentences can be helpful to bring information across in a concise manner. While many, long sentence make it more complicated to follow the information provided. Especially since autistic people might not understand the sentences or loose interested due to the length.
	18. Style of Document	Plenty of instructions caused information overloads due to the amount of information provided on the document especially, if it was not grouped or sentences were particularly long. When looking at the amount of paragraphs, it becomes clear that they can contribute to overload, if there are no sections are deliberate groupings of information. If there are many paragraphs which are not related to one another, it can also cause problems due to missing connections. This is very crucial when there is no guidance for users on how to read the instructions and the user can otherwise get lost on the document. Autistic people might struggle with choosing how to approach a document and can therefore become very confused by it.
	19. Wording	The instructions frequently used the same words within one document and made use of colloquialism and phrases. The usage of the same words can become repetitive and accidentally similar and might make it harder to distinguish information, which can cause problems for (autistic) readers. Using colloquialisms can seem like a random change in style and might therefore be negatively perceived. And usage of phrases is a risky choice, since people with autism are not good at

		understanding expressions but rather take things seriously or might again get confused by monotonous writing.
	20. Rhetorical Devices	Most documents used rhetoric devices. Especially the tricolon was frequently used. The three-step approach of the rhetoric device can be calming and predictable and therefore, might benefit the understandability and perception of the instructions. A similar effect could be achieved through assonances and alliterations as well as parallelisms. They might highlight aspects which belong together if intentionally used but could also lead to a disappointed anticipation of similarity if not used on purpose. This could cause people with autism to wonder about the intention of design choices even if there is no thorough explanation for it. A trope such as a heading of the instructions phrased in a way related to a different context, such as the Dutch document using a military terminology can be an interesting sentiment to achieve attention and emotional attachment to the instruction. It can also be confusing, if it expects the reader to read between the lines and therefore comprehend something that cannot be expressed literally. Therefore, the usage of such a rhetoric device can be suitable for the general public and mostly could be applied in a way that does not disturb an autistic perception. In any case it should be considered if the statement could somehow be misinterpreted and could lead to confusion for an autistic person.
	21. Other Remarkable Features	Many documents make use of slogans in order to encourage the public to follow the rules. The slogans can be beneficial to improve morale and convey a supportive feeling. But they can also cause confusion if they are unclear or contradict each other. Therefore, the slogan should clearly meet the expectations of a reader regarding the situation. A very relevant aspect are typos in such instructions. People with autism are incredibly skilled at spotting tiny mistakes, which go unnoticed by most. They are subsequently drawn to look at the mistake again or to lose (some) faith in the quality of the document due the expectations that errors should have been removed before the publication. A solution could for example be to ask people with autism to proof-read instructions before publishing them to avoid such mistakes. Lastly, the usage of a timeframe on how long the crisis rules remain active initially sounds like a positive idea in order to support the autistic preference for guidance and making plans ahead of time. But, making such a promise on how long a rule will remain active can be a gamble if the phrasing is ambiguous

		and the person might think that the rule does not hold anymore after the time, even if the applicable timeframe was extended or the contradicting dates could cause confusion. Therefore, the very positively meant design choice, needs to be applied carefully to actually serve autistic needs.

Appendix 6 - Instructions Study II

				
Canada	China	Germany	The Netherlands	United States

Appendix 7 - Order of Materials presented

	Neurodivergent			Neurotypical
A = Canada	A B C	C B A	A C E	A B C D E
B = China	B C D	D C B	B D A	B C D E A
C = Germany	C D E	E D C	C E B	C D E A B
D = Netherlands	D E A	A E D	D A C	E A B C D
E = United States	E A B	B A E		A B C D E

Appendix 8 - Extensive Results Study II

Visual aspects:

- Structure
  - Hierarchy
    - Provide guidance e.g. by using numbers or arrows, if the document should be read in a certain order. The hierarchy reduces the effort for the reader to gather information.
    - Provide hierarchy in the points according to importance. Mark the most important elements to look at, to provide structure and grab attention.
    - Similar things should be treated equally. E.g. Each information should receive a separate sentence each.
    - The most important points should be the first thing to read. The rest can then become smaller.
    - Mention which information is novel.
  - Layout
    - Keep the document plain and restful to read. It should contain as little distracting, sensory stimulation as possible. Using as much white space as possible can be beneficial in achieving this.
    - Spread out the information instead of clustering it.
    - Be consistent with the layout in groupings/boxes.
    - Balance in the length of paragraphs/sections.
    - Sort information into different blocks.
    - Provide a heading so that it is clear what the document or section is about.
    - Avoid similarities or the indication of a structure if there is non. This is very confusing for people with autism. It is hard for them to imagine that there is no intention behind the design.
    - Providing all information on one page enables a good overview of the entire content. It also makes sure that the document focusses on the really relevant aspects.

        - The document should resemble that someone put effort, thought and time into the design. It should not seem random.
        - Don’t use too many and too detailed instructions close together/about the same topic, because they might be forgotten.
        - Do not change the style throughout the instruction to accommodate a different design.
    - Alignment
        - Make sure the design is properly aligned. E.g. putting information inside a box, not overlapping. Using boxes is a more comprehensive way to group information than in paragraphs, as they can be closed off and placed next to each other conveniently. Consider giving the boxes headings for improved orientation.
- Design
    - Colours
        - Colours need to have a purpose.
        - Use colours that are easy to distinguish and differentiate.
        - Use colours according to the role/relevance of the information.
        - Flashier colours catch attention, so use them wisely.
        - Colours should not be too bright. Otherwise, the document might look irrelevant or like an advertisement.
        - It can be beneficial to make use of a legend to explain the intention of a colour.
    - Images/Pictograms
        - Only use pictures prominently if they convey relevant information. Otherwise they seem useless and they should not interfere.
        - Use pictures/pictograms to support the textual statement. Text and images have to match. Otherwise, they cause confusion and both of them are not useful anymore.
        - Make sure pictures can be distinguished from each other. Do not use the same picture for different purposes. The expectation is that they mean the same.

        - Pictograms should be able to stand by themselves and be clear even without the text.
        - Images convey emotions and give an idea of the situation faster. It is less likely to be misunderstood and provides clarity. Especially for people who cannot read.
    - Legibility
        - Use proper contrast.
        - Use readable font size (Necessity for a sufficient visual stimulus).

Linguistic aspects:

- Comprehensibility
    - Prepare the reader what they will encounter. Assure the reader that they will be able to read this and follow the steps.
    - Using a second language in a document can be confusing. Consider having separate documents per language placed closely together, so that the readers can choose the information relevant to them.
- Conciseness & Focus
    - Keep things simple.
    - Make it very clear what the most important parts are and what the reader should do.
    - Condense information. Especially on posters or other things people should comprehend fast. Do not make it too long or too full, otherwise it might lead to a loss of focus of the reader.
    - Avoid typos at all costs. Typos are really confusing! People expect that the organisations should be able to review and correct their documents thoroughly.
- Phrasing
    - Use short chunks of text to provide information, otherwise you lose attention.
    - Use common, easily understandable language.
    - Be specific with phrasing and refrain from things which can be taken literally. Avoid unrealistic, non-precise, inexact phrasings. Do not make things too narrow e.g. by giving examples, if not necessary.

- Choose one term for e.g. the virus and stick with it to avoid confusion by suddenly using “synonyms” unannouncedly.
- Do not use commands or address people in an arrogant manner but choose reasonable instructional phrasings to convince people to adjust their behaviours.

Content aspects:

- Credibility
  - Portray the source the document is made by clearly and prominently, e.g. at the top of the document - provide information upfront). Use logos of credible, governmental sources, to improve the reliability and perception of the document.
- Relevance
  - Make visible what is new in this document compared to previous editions.
- Referral
  - Provide access to further information via different channels. Provide different options according to people’s preferences.
  - It can be beneficial to provide necessary information on the poster and let the reader know, that there is more information available if they want to read it calmly at a different moment.
- Predictions
  - Providing timeframes for the validity of the information can lead to misunderstandings if there are different versions of the instructions and if the application of such times changes.

Differences between Neurotypical People and Neurodiverse People:

- NT people prefer the usage of decorative pictures to attract attention and make documents livelier. ND people perceive this as distracting and unnecessary.
- NT people prefer it if instructions are colourful and exciting in order to attract attention and prevent boredom while looking at it. ND people prefer “plain” and simplistic documents which provide calmness while reading and focus on necessities instead.

- NT people think that people do not need to be that detailed, as they understand the intention sooner and see the additional details as chaotic. ND people appreciate extensive, detailed visualisation as it supports them in understanding a (social) situation.
- NT is better at finding explanations for irregularities such as seemingly random colour choices and can ignore them better. While ND people might get stuck based on such a thought and might struggle to accept that something was not done intentionally and is "just" inconvenient.
- NT people are able to navigate through documents with relative ease. ND people are much more attentive to details and inconsistencies and can therefore spot errors and problems with more speed and accuracy.