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# A conceptual model for approaching the design of anti-disinformation tools

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**Abstract.** With the increasing amounts of mis- and disinformation circulating online, the demand for tools to combat and contain the phenomenon has also increased. The multifaceted nature of the phenomenon requires a set of tools that can respond effectively, and can deal with the different ways in which disinformation can present itself, such as text, images, and videos, the agents responsible for spreading it, and the various platforms on which incorrect information is prevalent. In this paper, after consulting independent fact-checkers to create a list, we map the landscape of the most known tools that are available to combat different typologies of mis and disinformation on the basis of three levels of analysis: the employment of policy-regulated strategies, the use of co-creation, and the preference for manual or automated processes of detection. We then create a model in which we position the different tools across three axes of analysis, and show how the tools distribute across different market positions. The most crowded positions are characterized by tools that employ automated processes of detection, varying degrees of policy implementation, and low levels of co-creation, but there is an opening for newly developed tools that score high across all three axes. The interest in co-creative efforts in the challenge towards addressing mis- and disinformation could indeed be an effective solution to cater to the need of the users, and respond effectively to the amounts and variety of mis and disinformation spreading online.

**Keywords:** Disinformation; Misinformation; Anti-disinformation tools; Fact-checking; Co-creation, Policy.

## 1 Introduction and problem discussion

The issue of misinformation in social media is currently attracting a lot of attention, especially for the effects that it has on health-related and political behaviour, among other realms of interest [3]. Structural evidence of scientific research on misinformation phenomena can, for instance, be found in studies like the one conducted by Allport and Postman [1], in which they identified “the basic law of rumour”, demonstrating that the strength of a rumour is dependent on the importance of the subject and individual concerns regarding this as well as of the time and ambiguity of the evidence on the topic. While misinformation in itself is not a new phenomenon, as the Allport and Postman

study from 1946 shows [1], the social media era has made it more pervasive. The 2000s has witnessed a rapid development of social media that has facilitated a spread of both information and misinformation regarding everything from local neighbourhoods to global issues. Studies analysing misinformation on social media platforms, have found that misinformation and disinformation travel faster than trustworthy information [20]. That has put social media platforms and their architecture at the centre of discussion on the spread of misinformation. While platforms like Facebook, Twitter and Instagram have started collaborating with fact-checkers to flag incorrect information, and giving users the possibility to report items for fact-checking, the tools provided by these platforms do not yet responding effectively to the demands. Furthermore, the echo-chamber-like structure of the networks within social media platforms [8, 17], and the personalization process carried out by algorithms, reinforce existing biases within the users [18], who tend to be exposed mostly to information that reinforces their pre-existing beliefs. Research on misinformation in the media has been progressing rapidly, with studied contextualizing misinformation within different realms and events, such as within journalism [5], and in the context of elections [21], and also trying to predict and identify future challenges [7].

Other studies have focused on taxonomizing the phenomenon [4]. The taxonomy of Giglietto et.al [9] is based on factors such as perceptions of the source, the story, the context, and the decisions of the audience and the propagator. The authors propose a taxonomy of “pure disinformation” where both the original author and the propagator are aware of the “false” nature of information, but they nevertheless decide to share it. A different situation is the one called “misinformation propagated through disinformation” where information is originally produced as “true” and then shared by a propagator who believes it is “false”. Finally, “disinformation propagated through misinformation” is the situation in which information is devised as “false” by a creator but is perceived as “true” by a propagator.

On the ground the fact-checking work, i.e. the act of taking up published information, examining it for factualness and veracity and the re-publishing it, has also been carried out intensively in the past years. Given the demand for fact-checking, several tools have been developed to help the users navigate the information landscape within social media. It is these tools that are the object of research for this paper.

## **2 Aim**

The aim for the proposed model in this paper, is to map the current anti-disinformation tools landscape, by analysing the architectural choices that govern the tools’ functioning and response to disinformation. We see tools as software developed with the intention to detect and in some way judge and give the user a notice of mis/disinformation. In this way, we provide a framework for understanding what is available to the users, what is missing within the current landscape, and in which direction the tools should evolve in order to provide diversified options catering to the users’ needs, as well as to

effectively address different typologies of disinformation in different online environments.

### **3 Literature review on the qualities of anti-disinformation tools**

The work on combating disinformation can take on many shapes, at least as many as disinformation itself. Farrell and colleagues [6] outlined some of the specific problems that misinformation detection has to address. The authors also explain some different models of how misinformation spreads that are relevant for detection, and provide a typology of anti-misinformation tools such as style-based, knowledge-based, propagation-based or credibility-based tools. They position tools within the misinformation ecosystem, with regard to how, when and what kinds of misinformation they handle. However, the study does not focus on the users' perspective, a gap that is taken up by the work of Komendatova et. al [11]. The authors reviewed disinformation tools in the perspective of design approaches, putting them into a perspective of value driven design. They found that design qualities of a lean back character i.e. not favouring active engagement are preferred by stakeholders, if compared to approaches favouring user engagement. This multitude of shapes and qualities that anti-disinformation tools can assume, shapes the ontology of the theoretical model we propose.

Still some qualities seem to be present across many of the tools, and refer to how they are constructed, how they function, and what they allow. Within the main qualities that have been identified, the tools we examined in this study can rely on either automated or manual fact-checking, which means that the veracity of the information is assessed either by algorithms who rely on the existing databases of fact-checked information, or by humans who check the claims against other verified sources of information. They can be either proactive or reactive (i.e., what we will call "policy" versus "ad hoc), meaning that they either set up strategies to prevent the circulation of misinformation, *ex ante* or they react to misinformation at the point when it is detected in the system, *ex post*. Or finally, the tools can to varying degrees rely on collaborative, co-creative efforts. This means that some tools allow the broader community of users to provide information in different forms, such as flagging, fact-checking or feedback on the fact-checking process.

Our object of research is the ontology of design qualities, that make up the conceptualization space of anti-disinformation tools. We do that by organising a theoretical model of the conceptualization space. With this we take a perspective of critical realism and constructionism [15].

### 3.1 Aspects of anti-disinformation tools

As highlighted in the previous paragraph, three main qualities of the existing anti-disinformation tools indicate how these approaches disinformation (proactively or reactively, namely establishing policies a priori, or establishing ad-hoc strategies to respond to specific cases), which modality they use to analyse it (manual or automated) and to what extent they allow joint efforts (degree of co-creation). We have also found Babakar [2] inspiring, as they postulate that fact-checking exists in a triangular trade off where the angles are; Speed: how quickly the task can be done; complexity, and how difficult the task is to perform. Babakar [2] can be seen as a precursor to the model of this study. Their triangle corner of Speed versus Difficulty relates to this study's axis of AI/Handicraft and their third angle of Complexity can relate to this study's axis of policy. Their notion of how a systems designer can only optimise for two of these at a time relates to how our studies' cube model postulates and illustrates inherently opposed trade-offs. On the basis of all these identified qualities, we proceed to build our model.

**Degree of Policy.** One of the axes of our model is dedicated to assessing to what extent a tool is driven by policy. The degree of policy is measured in high and low, where "policy" represents the high end of the spectrum, and "ad-hoc" represents the opposite, low end. With the "degree of policy" we measure to what extent the various anti-disinformation tools on one hand establish rules that regulate the definition and circulation of misinformation "*ex ante*", and an instance of misinformation detected according to these policies triggers the tool. Or on the other hand tools that evaluate circumstantially the single cases. Hence a high-end place on the spectrum represents a tool design based on an *ex ante* policy that drives the judgements of the tool, a low end is a situation of a more flexible character that evaluates instances of misinformation *sui generis, post facto*. Research in the area of policy has shown that policy work is crucial in a user-focused conceptualization of anti-disinformation tools [10, 19] Furthermore, the many and varied taxonomies of disinformation contribute to showing that an awareness of policies, may be advantageous when devising a user centred approach.

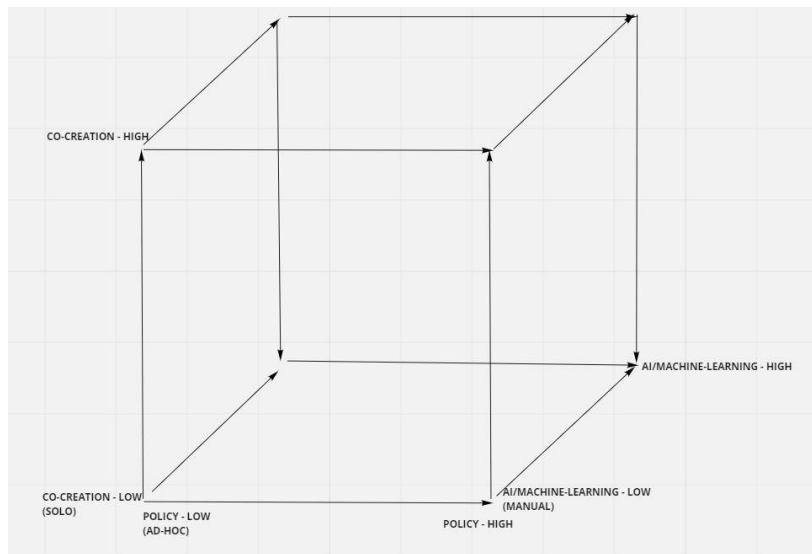
**Degree of AI.** The second axis of our model is dedicated to the assessment of the extent to which the misinformation detection process is carried out by means of manual or automated fact-checking, applying AI and machine-learning. The amount of information that requires fact-checking produces an increasing demand for a number of tools and fact-checking services that rely on the use of AI to assess the veracity of the information. This approach can either be used as the sole method of information scanning, or in conjunction with manual fact-checking. Therefore, in our model we measure the degree of AI, where "AI/Machine learning" represents the high end of the spectrum, and "manual" represents the opposite, low end of the spectrum.

**Degree of Co-creation.** In the last few years co-creation has spread rapidly in the business sector as a way of engaging with stakeholders and building knowledge. The

application of co-creation methods is more recent in the public sector, particularly for policy development, and multiple challenges still need to be overcome [16]. It has been suggested that co-creation of anti-misinformation work in the public sector can be a way of meeting the multifaceted complexity of the task of anti-misinformation work [12]. Therefore, in our model, we measure the level of co-creation, where “high degree of co-creation” represents the high end of our third axis, and “low degree of co-creation (solo)” represents the opposite, low end of the same spectrum. In our model co-creation is intended as the extent to which the tools allow contributions and inputs from larger communities of users while carrying out the fact-checking work.

#### 4 A model for evaluating anti disinformation tools for conceptual purposes

The presented qualities can be imagined as axes and presented as a model in the form of a cube. This form of model also illustrates how we postulate the three qualities to be communicating buckets. We apply the examples that follow below as a means of validation.



**Fig. 1.** Organization of the axes in the cube

#### 5 Review of anti-disinformation tools

In the past few years, several tools that rely on both automated and "manual" fact-checking, or on a combination of the two modalities have been developed to help users navigate the information encountered online.

The overarching aim of these tools is to fact-check different aspects of the disinformation content, such as the information architecture (e.g. the claims, the sources, the authors and the platforms), and aspects related to the typology of content (e.g., images, headlines). These tools can be employed as a way to prevent the spread of disinformation, or as a way for a user to react to it.

Among the tools that more generally assess the content are; NewsGuard<sup>1</sup>[14], ClaimBuster<sup>2</sup>, The Factual<sup>3</sup>, CredEye<sup>4</sup>, Public Editor<sup>5</sup>, and Newstrition<sup>6</sup>. Within these, tools like Cyabra<sup>7</sup> employ more advanced technologies to detect deep-fakes, and the Co-Inform Dashboard<sup>8</sup> is designed to help professionals such as journalists, fact-checkers and policy-makers in their everyday job.

Some social media platforms have developed their own fact-checking systems, often in collaboration with external fact-checking organizations. Examples of these are the Facebook Fact Checking Program<sup>9</sup>, Twitter Birdwatch<sup>10</sup>, and the Whatsapp IFCN chat-bot<sup>11</sup>.

Besides the tools developed in collaboration with the platforms, there are also platform-specific tools developed externally, like CaptainFact<sup>12</sup>, designed for YouTube, Foller.me<sup>13</sup>, the Co-Inform plug-in<sup>14</sup> and Hoaxy<sup>15</sup>, designed for Twitter, FakeSpot<sup>16</sup>, specific for e-commerce platforms, and tools like Botometer<sup>17</sup> that are not only platform-specific, but also agent-specific: Botometer provides information about the probability that a Twitter account is a bot. Other tools are content-specific, for example TinEye<sup>18</sup> focuses on detecting fake and decontextualized images, and the WeVerify/InVID plug-in<sup>19</sup> is created for the assessment of videos.

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<sup>1</sup> <https://www.newsguardtech.com/>

<sup>2</sup> <https://idir.uta.edu/claimbuster/>

<sup>3</sup> <https://www.thefactual.com/>

<sup>4</sup> <https://gate.d5.mpi-inf.mpg.de/credeye/>

<sup>5</sup> <https://www.publiceditor.io/>

<sup>6</sup> <https://our.news/>

<sup>7</sup> <https://cyabra.com/>

<sup>8</sup> <https://coinform.eu/>

<sup>9</sup> <https://www.facebook.com/journalismproject/programs/third-party-fact-checking>

<sup>10</sup> <https://twitter.github.io/birdwatch/about/overview/>

<sup>11</sup> <https://faq.whatsapp.com/general/ifcn-fact-checking-organizations-on-whatsapp/?lang=en>

<sup>12</sup> <https://captainfact.io/>

<sup>13</sup> <https://foller.me/>

<sup>14</sup> [www.coinform.eu](http://www.coinform.eu)

<sup>15</sup> <https://hoaxy.osome.iu.edu/>

<sup>16</sup> <https://www.fakespot.com/>

<sup>17</sup> <https://botometer.osome.iu.edu/>

<sup>18</sup> <https://tineye.com/>

<sup>19</sup> <https://www.invid-project.eu/>



Finally, tools are being developed not only to detect, signal and correct misinformation, but also to work on the critical thinking and analytical abilities of the users, and one of these is Fiskkit<sup>20</sup>. To make sure that fact-checking work is carried out transparently and to counter the rise of counter-fact-checking initiatives, the International Fact-Checking Network<sup>21</sup> provides information and assessments on the credibility of the various fact-checkers and fact-checking initiatives [14].

## **6 A model for evaluating the concept space of anti-disinformation tools.**

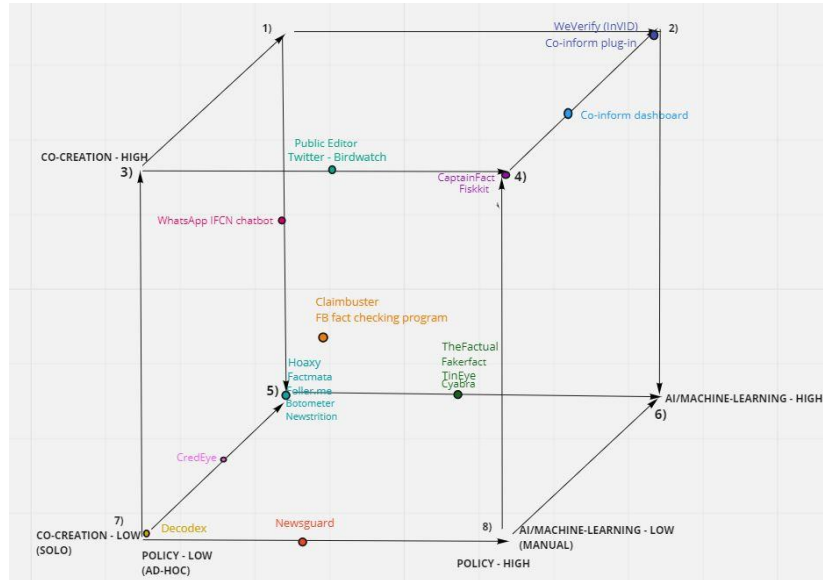
We have proposed a model to be used to categorize and define anti-misinformation tools from the perspective of the functionalities encountered by the user. Here we map a number of chosen examples to the cubic model. We made a theoretical sample and in February 2021 we tested the content validity of the choice against a panel of nine experts from the IFCN network<sup>21</sup>. The chosen tools are placed within the cube in a place that represents their position in relation to the three axes. The bottom horizontal axis represents the degree of policy, moving from left (lowest degree) to right (highest degree). The vertical left axis represents the degree of co-creation, moving from the bottom (lowest degree) upwards (highest degree). Finally, the third and last dimension, which indicates the degree of AI/Machine-learning, is placed at the conjunction point with the policy axis and is visualized as the “cube depth axis”, which moves starting from the conjunction point with the policy axis (lowest degree), and runs alongside the bottom of the right cube face until the next conjunction point (highest degree).

In the previous section we proposed a model to be used to categorize, define and evaluate converging media to be considered for use when approaching anti disinformation tools. The cubic structure of the model, based on the three aspects or dimensions discussed above and shown in Fig. 2, makes it salient how the axes are connected vessels. To be evaluated, a disinformation tool is measured with a design analysis and positioned in the cube with respect to the three dimensions, and then evaluated from its position. In the following final section of the chapter we apply the proposed model to a number of examples in order to show whether it can be used as intended

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<sup>20</sup> <https://fiskkit.com/>

<sup>21</sup> <https://ifcncodeofprinciples.poynter.org/>



**Fig. 2.** Distribution of the mapped tools across the cube

## 7 Application of the proposed model on anti-disinformation tools

The model presented above, whilst being theoretical, presents several practical implications. We can see a crowded market position in the fifth corner with Hoaxy, Factmata Foller.me, Botometer, and Newstrition. These are all characterized by high degrees of AI/Machine-learning, and low degrees of policy and co-creation.

The second most-crowded market position we find in the middle between the fifth and the sixth corners, it is represented by tools like The Factual, FakerFact, Tin-Eye and Cyabra. These tools score similarly across our axes, and they are characterized by a high degree of AI/Machine-learning, a medium degree of policy, meaning that they use a mixed approach, and a low degree of co-creation.

We can observe that the third corner is empty. It is defined by a high degree of co-creation, a low degree of policy and a mostly manual process. However, it would be unlikely to see an anti-disinformation tool in that market position, as the functioning and usability of such a tool would be impaired by these very characteristics. To provide an example, a platform that perhaps represents this position is Reddit, but it is not within the realm of anti-disinformation tools. The other tools appear to be more diversified across the various axes, with the exception of WeVerify (InVID), the Co-inform plug-in, and the Co-inform dashboard, which are roughly grouped in the same area round the

second corner: the Co-inform plug-in and WeVerify are both characterized by high degrees in all the axes (AI/Machine-learning, policy and co-creation), while the Co-Inform dashboard also has high degrees of policy and co-creation, but medium degrees of AI/Machine-learning. These are among the few that meet up to the idea of applying co-creation to meet the demands of combatting disinformation (cf. 3.2.3). It is unlikely that the tools in the crowded fifth corner defined by being high in AI, low in policy and low in co-creation will develop away from that corner. This is due to them being designed as stand-alone tools that are not part of any ecosystem, and that is an intrinsic design quality in these that is unlikely to change in the short term.

Birdwatch is an interesting case, it occupies a unique position with being high in human processing and co-creation while being highly dependent on policy. Its future position is dependent on the way it manages to over time keep and implement policy, we can right now in March 2021 see that the design qualities of Birdwatch may be moving it towards the empty corner of a high degree of co-creation, a low degree of policy and a mostly manual process.

This is a conceptual study, a natural next step would be to bring users into the picture, and examine their perceptions exploring e.g. how design qualities are categorized into product definitions, c.f e.g. [19], [20], to deeper explore user needs.

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## Appendix

Here follows a table that lists tools onto the three axes that make up the model. Some tools of these are in competition some are complementary.

**Table 1.** Selected tools and axes evaluation

<b>Tool</b>	<i>Policy:</i> (Re-active vs Proactive) <b>(low/medium/high)</b>	<i>Process:</i> (Manual vs AI/Machine Learning) <b>(low/medium/high)</b>	<i>Creation:</i> (Solo vs co-creation) <b>(low/medium/high)</b>	Notes
Public Editor	medium	low	Community/high	
Botometer (by OSoMe)	low	high	low	
CaptainFact (France) (plugin)	high	low	high	Focus on inserting fact checks in videos.
Claimbuster (human input)	medium	medium	medium	Human assisted matching learning to identify potential claims
Co-Inform (plugin)	high	high	high	
Co-Inform (dashboard)	high	medium	high	
Cyabra	medium	high	low	
Decodex (Le Monde) (France) (plugin) ; run by journalists) (how) (why)	low	low	low	Focus on source credibility
Facebook Fact-Checking Program	medium	medium	medium	Facebook Third-Party Fact Checking

				Program with IFCN-verified partners
Factmata	low	high	low	
FakerFact (plugin)	medium	high	low	
Fiskkit	high	low	high	Works on the critical thinking and analysis skills
Foller.me	low	high	low	Similar to MisinfoMe
Hoaxy (by OSoMe)	low	high	low	Similar to MisinfoMe
NewsGuard (plugin)	medium	low	low	Focus on source credibility; run by journalists
Newstrition	low	high	low	
TheFactual (plugin) (how) (who)	medium	high	low?	Focus on article credibility
TinEye replace AI and crowdsourcing as opposites..	medium	high	low	Reverse image search
Twitter Bird-watch	medium	low	high	Crowd-sourced fact checking
WeVerify (InVID) (plugin)	high	High	high	Focused on videos.
Whatsapp IFCN Chatbot	low	High	medium	
CredEye	low	medium	low	Web page. Produces <i>credibility</i> score of a given text

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