



M-TOOL Manual

App-based version

Welcome to M-Tool! This manual lays out the key features and information on how to use M-Tool and tailor it to your needs.

What is M-Tool?

M-Tool is the Mental Model Mapping Tool developed by Dr. Karlijn van den Broek, Dr. Helen Fischer and Dr. Sina Klein at University of Heidelberg, and Joseph Luomba, researcher at Tanzania Fisheries Research Institute (van den Broek et al, 2021a). M-Tool is designed to capture mental models, internal representations that describe an external environment. The external environment can be any type of system that consists of factors and causal links between those factors. This tool has been validated with rural fishing communities, demonstrating both convergent and external validity (van den Broek et al., 2021b).

M-Tool allows respondents to create models of a particular system by organizing relevant factors and linking them. M-Tool is available as a free app that can be downloaded in the google and apple app stores, and as a web-based version which can be used in a browser. The latter version also includes a bar chart drawing feature, in which participants display their views on their relation between two variables, for example the fluctuation of a particular resource over time. This manual lays out how to use the app-based version.

The left example below illustrates a fisher's mental model of the drivers of the changes of the Nile perch stock (van den Broek et al., 2021b). It shows that this fisher believes that the strongest influence on the fish stock is fishing in breeding grounds (thick arrow), which is influenced by climate change, which in turn also has a direct influence on the Nile perch stock, as well as the use of illegal gear. The example on the right illustrates a more complex mental model captured with M-Tool. For more examples of applications of M-Tool in research projects see <https://www.m-tool.org/Publications/>



Figure 1. Examples of a simple (left) and complex (right) mental model created with M-Tool. The figure shows mental models of Tanzanian fishermen of the drivers that influence the target variable, the Nile perch stock.



Why use M-Tool?

- A standardized tool – for comparing mental models
- Suitable for large sample sizes
- Does not require respondents' literacy
- No internet connection required during sampling
- Can be tailored to map perceptions of any system or phenomenon

In contrast to other mental model elicitation methods, M-Tool uses a fully computerized approach that allows rapid collection of large samples. M-Tool's standardized approach ensures respondents will use the same system variables with which they draw their mental model. M-Tool hence gives you the unique benefit of comparing the mental models across and within (groups of) respondents. M-Tool is the first mental modelling tool to allow users to uncover differences in mental models which may keep stakeholder groups from addressing challenges jointly and effectively (van den Broek, 2018).

Because you can populate the tool with icons representing different system variables yourself, mental models of any kind of system can be captured. Some examples of how M-Tool can be used:

- Comparing mental models between groups of respondents (e.g. different types of stakeholders, experts vs. the general public, across cultures, communities from different geographical areas, comparing children's mental models).
- Assess changes in mental models over time, to investigate the stability of mental models or the impact of an intervention on the respondents' mental model.
- To start a conversation between stakeholders on the functioning of a system and how to address challenges within the system.

Compared to interviewing techniques, M-Tool allows respondents to draw more complex mental models, thereby giving more detailed insights into their understanding of a system (van den Broek et al., 2021b). Moreover, by including video instructions, icons to display the relevant system variables, and accompanying audio files explaining each icon, M-Tool can be used without relying on respondents' literacy.

Tailoring M-Tool to your needs

M-TOOL allows you to populate the tool with factors that are relevant for your project. These factors can be generated by your mental model target group, for example through short interviews or surveys (e.g. What are the elements of [a system], What factors do you think drive..., what are the consequences of ...). Alternatively, you may be interested to see if your target group would make certain connections based on an existing set of factors. These factors may be informed by pre-existing knowledge of a system, i.e. to assess if you target group can draw up the 'correct' dynamics between factors. Furthermore, you can replace the audio instructions and videos with your own files to adapt the instructions to your needs, or to translate it to the relevant language.

M-TOOL can be set up in various ways:

1. The drivers and consequences of a target variable (i.e. the fixed factor: the fish in Fig. 1 or "Y" in the app) can be mapped separately (by placing the target variable on the left for mapping screen 1 and on the right for mapping screen 2). This eases the cognitive demands on the respondents.
2. The drivers and consequences of a target variable can be mapped at once, so a respondent can show how the drivers and consequences can influence each other (e.g. by placing the target variable in the middle).
3. Alternatively, the tool can be set up without a target variable/fixed factor, so the respondent maps the entire system.

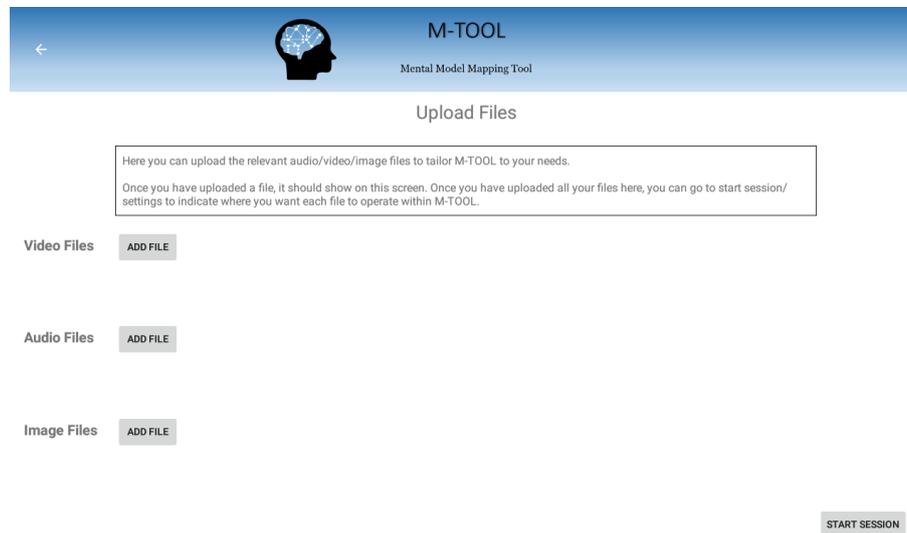


This means that you can map any aspects of any system (e.g. network of actors, dynamics of an ecosystem etc.).

How to use M-Tool?

To get started using M-Tool, follow these simple steps:

1. Generate a list of relevant factors for the respective system.
2. Turn these factors, as well as your 'target variable' (if applicable) into images (e.g. through a freelance graphic designer platform like [Fiverr](#) or use images with text).
3. Create a video that explains the meaning of each image (e.g. [with PowerPoint](#))
4. Extract the audio files from this video for each image (e.g. [using PowerPoint](#))
5. Save these files on your device, then upload these files in the app under *upload files*. (Note: the files to be uploaded should not exceed 150MB. iOS users are advised to save the files in the M-Tool folder created on their device by the app to ensure access.)





- Set-up the uploaded files under the respective headings under *settings*. Choose whether you want 1 or 2 mapping screens, whether to include positive and negative arrows, and whether/where to place the target variable.

Here you can use the files you have uploaded to populate the tool. Select the audio or video file from the dropdown box for the respective M-TOOL parts. Select the factors you would like to use for the mappings by selecting the image and audio file for each factor and select if you would like these factors to show on the first or the second mapping screen.

Mapping: Mapping Screen 1 Mapping Screen 2 Both

Add negative arrows: ?

Introduction video: ?

Instruction video for mapping screen 1: ?

Instruction video for mapping screen 2: ?

Practice audio: ?

Mapping screen 1 audio: ?

Mapping screen 2 audio: ?

Thank you audio: ?

Thank you image: ?

Factors:

Mapping screen 1 Mapping screen 2

Fixed factor:

Fixed factor position:

Use?	Name	Image	Audio	Explanation (optional)
<input checked="" type="checkbox"/>	A	A.png	A.m4a	
<input checked="" type="checkbox"/>	B	B.png	B.m4a	
<input checked="" type="checkbox"/>	C	C.png	C.m4a	
<input checked="" type="checkbox"/>	D	D.png	D.m4a	
<input checked="" type="checkbox"/>	E	E.png	E.m4a	
<input checked="" type="checkbox"/>	F	F.png	F.m4a	
<input checked="" type="checkbox"/>	G	G.png	G.m4a	
<input checked="" type="checkbox"/>	H	H.png	H.m4a	
<input checked="" type="checkbox"/>	I	I.png	I.m4a	
<input checked="" type="checkbox"/>	J	J.png	J.m4a	
<input checked="" type="checkbox"/>	K	K.png	K.m4a	
<input checked="" type="checkbox"/>	L	L.png	L.m4a	
<input checked="" type="checkbox"/>	M	M.png	M.m4a	
<input checked="" type="checkbox"/>	N	N.png	N.m4a	
<input checked="" type="checkbox"/>	O	O.png	O.m4a	
<input checked="" type="checkbox"/>	Y	Y.png	None	

Add Factor

Apply Cancel

- Go to *start session*, and enter a session number/comment as desired.
- Press start and hand-over the tool to your respondent. Your respondent will first complete a practice task to familiarize themselves with the tool. They can only move on if they have completed this task successfully. Next, the factors for the mapping task are presented, followed by the mapping task itself. This is repeated if you choose two mapping screens.
- Download your participants' data under *start session/download data*. You can analyse this data using the M-Tool data analysis script (van Boxtel & van den Broek, 2021).

Data safety

The data generated with M-Tool can be downloaded to the local device only. No third parties (neither the creators) have access to this data.



Recommendations for using M-Tool

We recommend using a tablet device (or run the app on a desktop with an emulator), as the display and functionality is not optimized for small screens. M-Tool is compatible with Android version 4.1 ("Jelly Bean") up to 10 ("Android 10"), but has been tested with Android 5.1.1 and Android 10 only.

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Contact

For more information on M-Tool, go to www.m-tool.org

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