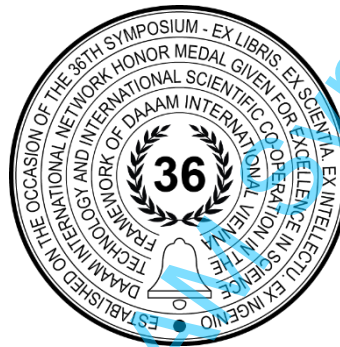


CAN THE DOBOT MAGICIAN REPLACE THE PRUSA MINI+? A QUALITATIVE VISUAL ASSESSMENT OF FFF PRINT QUALITY

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Abstract

This study examines whether the Dobot Magician robotic arm can replace the Prusa Mini+ for selected Fused Filament Fabrication (FFF) tasks at comparable visual quality. Preliminary trials included five predefined profiles, a separately adjusted Dobot setting and a simple geometric specimen with circular features, a hole and straight edges. The final comparison used a whistle, bookmark, and keychain printed with the best settings independently found for each device during the trials. Quality was assessed through side-by-side inspection and photographs, without dimensional metrology or mechanical testing. The Prusa better preserved contours, lettering, small features and surface continuity. Dobot specimens remained visibly inferior, even with the filament supplied with the robot. The tested configuration, therefore, did not provide a quality-equivalent replacement for the evaluated tasks. Possible contributors include limitations in robot positioning accuracy and structural stiffness, as well as first-layer adhesion difficulties on the unheated build plate; the individual effects of these remain unverified.

Keywords: Additive manufacturing; Robotic 3D printing; Prusa Mini+; Dobot Magician; robotic arm; Equipment replacement

1. Introduction

Equipment selection in additive manufacturing should follow application requirements [1]. In Fused Filament Fabrication (FFF), molten thermoplastic is deposited layer by layer [2], while process settings influence surface quality and dimensional accuracy [3]. Robotic additive manufacturing extends production possibilities [4], but additional functionality alone does not establish equivalence in printed-part quality.

At the system level, simulation supports reconfigurable manufacturing control [5] and mobile-robot allocation [6]; digital-twin scheduling [7] and assembly-line operator rotation [8] address production efficiency and resource use. These studies evaluate the organisation of production rather than the shape and surface quality of individual printed parts.

For robotic workstations, Malega et al. link layout and tooling choices to task requirements [9]. A survey by Harničárová et al. highlights the practical usefulness, reliability, and user needs in the adoption of smart technology [10]. These broader perspectives provide context for equipment selection; the present study focuses specifically on whether a replacement preserves the quality of printed parts.

At the printing-system level, Pollák et al. assessed UR5 suitability through measurements of pose-characteristic drift and static compliance [11]. Mitařová et al. examined filament extrusion from virgin/recycled ABS blends, identifying diameter stability as a key factor in consistent material delivery [12]. These studies motivate considering both robot behaviour and process-related influences. However, results for the UR5 and ABS feedstock do not establish the causes of defects in the Dobot/PLA setup examined here.

Hofbauer et al. reported improved first-layer contact through probe-based bed compensation in robotic printing [13]. Ali et al. reported improved surface finish after cooling modifications in a robotic cell processing PLA granules [14]. Rosales Molina et al. assessed PETG prints visually and dimensionally [15]. Corradini and Silvestri developed a digital-twin-based self-calibration method to identify the speed and acceleration limits of a Cartesian FDM printer [16].

Csekei et al. compared the Dobot Magician with the Creality Ender-3 V2 and the Prusa i3 MK2 using optical scanning and reported comparable print quality for the Dobot in some cases [17]. This finding does not establish a quality-equivalent replacement for the Prusa Mini+ across different models and visual quality requirements. The present comparison, therefore, addresses a distinct practical question rather than attempting to reproduce or refute their dimensional measurements.

The present study compares the multipurpose Dobot Magician educational robotic arm, equipped with its 3D printing kit, with the dedicated Prusa Mini+ printer (Fig. 1). The Dobot workflow used RepetierHost and an unheated build plate, whereas the Prusa workflow used PrusaSlicer. Each device was evaluated using the best settings identified independently within the trials conducted.

The comparison concerns the complete printing setups, including their different motion systems, configuration procedures and printing parameters. Its primary focus is the quality of the resulting parts, rather than equipment versatility, purchase price or ease of software installation. Configuration and operating observations describe the conditions under which the specimens were produced. The study addresses two research questions:

Research question 1: Do the Dobot Magician and the Prusa Mini+ produce FFF specimens of comparable visual and geometric quality?

Research question 2: Can the tested Dobot Magician configuration replace the Prusa Mini+ for these printing tasks when comparable part quality is required?

The contribution is a documented commissioning and comparison report: it records what had to be set up before a complete specimen could be obtained from an educational robotic arm, and the quality the specimen reached against that of a dedicated desktop printer.

The assessment focuses on preservation of intended contours, circular and straight features, lettering, small gaps and surface continuity. Producing a complete object is distinguished from reproducing it with quality comparable to the Prusa reference. The study provides a practical qualitative comparison, not a statistical equivalence test or an isolated assessment of the robot's mechanics.

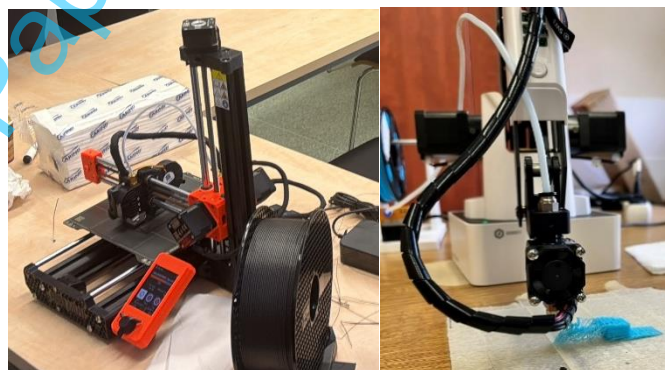


Fig. 1. Prusa Mini+ and Dobot Magician used in the comparison.

2. Printing settings and preliminary trials

For the final comparison, settings were selected separately for each device to reflect the best results achieved in the trials. For the Dobot, repeated preliminary attempts involved manually adjusting the starting nozzle height and printing parameters. The resulting configuration is referred to as the “Dobot Best Setting,” and “best” refers to the configurations tested, not to a proven global optimum. The Prusa trials compared predefined PrusaSlicer profiles, with the final configuration selected for its balance of observed print quality and printing time.

The preliminary trials covered five profile labels: 0.2mm Speed, 0.2mm Structural, 0.15mm Speed, 0.15mm Structural and 0.10mm Fast Detail. These labels are retained as recorded; “Structural” is a profile name and does not denote a measured strength result. The individual parameters transferred to the Dobot workflow are not fully documented. These attempts, therefore, represent profile-based commissioning trials, not proof that identical machine instructions or extrusion conditions were used on both devices.

The selected settings are listed in Tables 1 and 2. The aim was to compare the quality achieved with independently selected settings, rather than impose identical printing parameters.

For the Dobot, obtaining a complete specimen was a practical challenge in itself. Preliminary attempts repeatedly encountered first-layer failures and filament-feeding blockages, requiring manual adjustments to the starting nozzle height and printing parameters. The selected “Dobot Best Setting” represented the best result achieved within these trials: complete specimens could be obtained, but visible geometric and surface defects remained.

3. Methodology and assessment scope

The final comparison used three custom test models: a whistle with lettering on its upper face, a bookmark with a heart-shaped feature and lettering, and a keychain containing small internal forms and gaps (Fig. 2). These models were selected to compare visible surface quality, reproduction of intended contours and retention of detail. A separate simple geometric model was used during the preliminary trials (Fig. 3). It contains a circular feature, a circular through-hole and a straight connecting portion, and was obtained from the Printables model “Einkaufswagenchip” [18] rather than designed as an original model for this study.

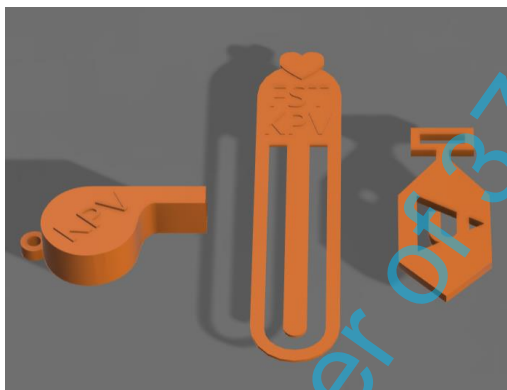


Fig. 2. Custom models used in the final comparison: whistle, bookmark and keychain.

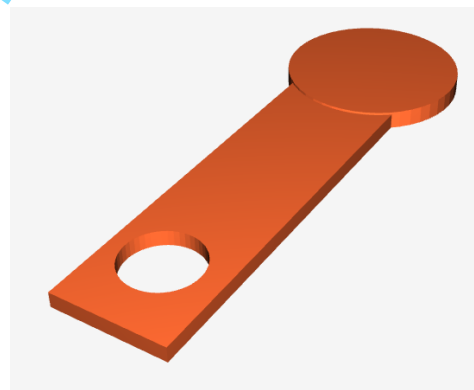


Fig. 3. Simple geometric model used in preliminary trials. [18]

The same final model geometry was imported and sliced separately in each printing workflow. Elapsed printing time was recorded, and specimens were compared side by side for visible shape deviations, lettering and fine-feature reproduction, and surface continuity. These observations and photographs form the basis of the qualitative assessment.

The recorded setup used 0.4 mm nozzles and 1.75 mm PLA filament for both devices. Prusament PLA was used for the whistle and bookmark, and the PLA supplied with the Dobot was used for the final keychain comparison on both devices. The change for the keychain was intended to examine whether the supplied filament improved the Dobot result. Because the model and filament changed together between these final tests, the three-model comparison does not isolate a filament effect.

Here, comparable quality means that the intended features are reproduced without the substantial visible contour, detail and surface defects identified in the side-by-side comparison. This is a qualitative basis for interpreting the recorded results, not a numerical acceptance criterion specified before the tests. No dimensional deviations, surface-roughness values, mechanical properties or functional performance measures are provided in the experimental record. Photographic views are not treated as independent repeated prints; a complete run-by-run count is unavailable.

Layers and infill settings	Dobot Magician	Prusa Mini+
First Layer Height	0.2 mm	0.15 mm
Layer Height	0.2 mm	0.2 mm
(Vertical Shells) Perimeters	3	2
(Horizontal Shells) Top Solid Layers	6	6
(Horizontal Shells) Bottom Solid Layers	4	5
Infill Fill Density	15%	15%
Fill Pattern	Rectilinear	Rectilinear
Top/Bottom Fill Pattern	Rectilinear	Rectilinear
Combine Infill	Every 1 layer	Every 1 layer
Solid Infill (every X layer)	0	0
Fill Angle	45°	45°
Solid Infill Threshold Area	0 mm ²	0 mm ²
Skirt	1 loop	0 loops
Skirt Height	0.2 mm (1 layer)	-
Brim	0 mm	0 mm

Table 1. Recorded layer and infill settings for the final comparison.

Motion speed settings	Dobot Magician	Prusa Mini+
First layer speed	6 mm/s	30 mm/s
Perimeters	10 mm/s	80 mm/s
Small perimeters	10 mm/s	45 mm/s
External perimeters	10 mm/s	45 mm/s
Infill	10 mm/s	110 mm/s
Solid infill	10 mm/s	120 mm/s
Top solid infill	10 mm/s	80 mm/s
Support material	10 mm/s	100 mm/s
Support material interface	10 mm/s	50 mm/s
Bridges	10 mm/s	50 mm/s
Gap fill	10 mm/s	60 mm/s
Travel (non-print moves)	50 mm/s	400 mm/s

Table 2. Motion speed settings for the final comparison. These are not measured machine speed limits.

For the configurations that yielded the best results in the trials conducted, the Dobot Magician nozzle temperature was set to 225 °C for the first layer and 220 °C for subsequent layers, with an extrusion multiplier of 1. The Dobot specimens were printed on the unheated glass build plate supplied with the 3D printing kit (Dobot Magician Edu kit). The Prusa Mini+ nozzle temperature was set to 230 °C for the first layer and 225 °C for subsequent layers, while the build plate temperature was set to 60 °C for the first and all subsequent layers. The recorded print times are presented in Section 5.5 as secondary results.

4. Commissioning and operating effort

The Dobot required manual RepetierHost configuration, including Receive Cache Size = 63, the printer shape and bed coordinates, filament diameter and temperature entries. The starting position was set by manually adjusting X, Y, and Z, pressing the “key” button to store the position, and setting the nozzle-to-surface gap to approximately the thickness of one sheet of paper. This is the commissioning procedure used here, not a measured calibration of positioning accuracy. First-layer failures and filament-feeding blockages occurred repeatedly during the Dobot trials. An excessive initial nozzle-to-surface gap was associated with poor filament deposition, whereas a gap that was too small was associated with obstructed extrusion. Difficulties also occurred with faster settings. Clearing an obstruction involved removing the supply pipe and cutting away accumulated filament. Also, achieving adequate first-layer adhesion on the unheated glass build plate was a recurring practical difficulty, and preliminary attempts repeatedly failed at this stage. These observations identify process difficulties, but do not quantify their individual contribution to the final geometric defects.

An additional start-up incident was recorded in which the Dobot became usable again after remaining unplugged for about one day; its cause was not established. RepetierHost time estimates also differed from elapsed printing times.

5. Results

The preliminary trials document the settings explored and the best Dobot configuration found. The final model photographs provide the main evidence for comparing the visible quality of the printed geometry and surfaces.

The Dobot trials using the five recorded profiles did not yield satisfactory specimens in the recorded series, whereas corresponding Prusa results were described as successful. Table 3 summarises the observations without interpreting profile names as identical conditions or assigning success percentages. Fig. 4 shows one representative failed Dobot attempt alongside the Prusa result.

Recorded profile/setting	Dobot Magician observation	Prusa Mini+ observation
0.2mm Speed	Poor first-layer deposition; printing not completed.	Complete specimen with the intended overall shape.
0.2mm Structural	First-layer failure; no satisfactory specimen.	A successful print with preserved detail was recorded.
0.15mm Speed	No successful first layer and no usable result.	A successful print with favourable observed quality and time was recorded.
0.15mm Structural	No satisfactory specimen despite repeated initial height adjustments.	A successful print was recorded.
0.10mm Fast Detail	No usable result was recorded.	A successful print was recorded.
Dobot Best Setting	A complete specimen was obtained, but geometric defects persisted, and a longer printing time yielded no apparent quality benefit.	Reference result obtained directly from a predefined profile, without repeated manual adjustment of the initial nozzle height.

Table 3. Qualitative outcomes of the preliminary profile trials and the separately adjusted Dobot setting.



Fig. 4. Preliminary 0.2mm Speed trial: failed Dobot deposition (blue) and the Prusa specimen (black).

With the best setting found for the Dobot, a complete specimen of the simple geometric model was obtained (Fig. 5). However, its internal hole appeared smaller than intended and irregular in shape, while an intended straight edge was visibly distorted. The corresponding Prusa specimen provided the better qualitative reference. No hole diameter or edge-deviation measurement is available. This result is important because visible geometric defects persisted in a completed, simple part; the quality difference was not confined to fine lettering or to unsuccessful first layers.



Fig. 5. Simple geometric specimens obtained with the recorded Dobot Best Setting: Dobot in blue and Prusa in black. Front view on the left and rear view on the right. The photographs were not calibrated for dimensional measurement.

5.1. Whistle

The Dobot whistle specimens exhibit visibly poor upper-layer closure and discontinuous, irregular surfaces (Fig. 6). The Prusa specimens retain a more continuous upper surface and clearer lettering (Fig. 7). On this visual evidence, the two devices did not provide comparable whistle print quality. The photographs do not establish the whistle's acoustic performance or identify a unique physical cause of the upper-layer defects.

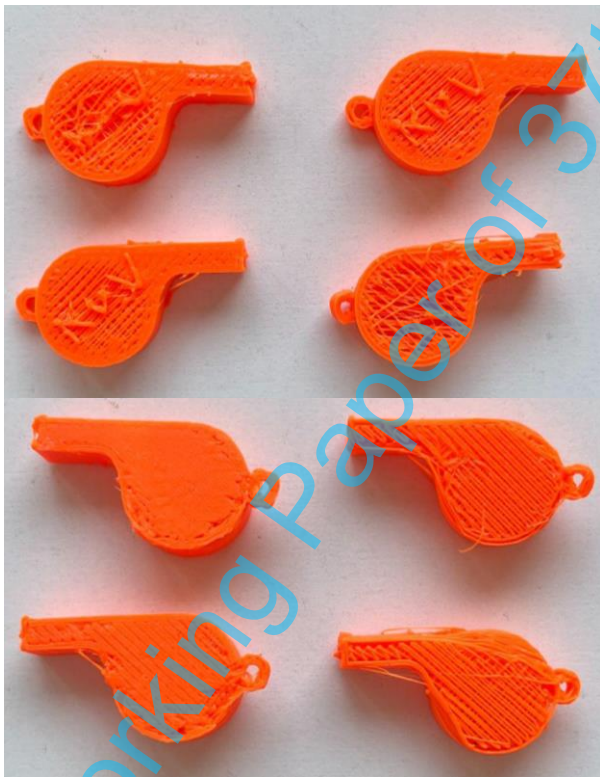


Fig. 6. Dobot Magician whistle specimens.



Fig. 7. Prusa Mini+ whistle specimens.

5.2. Bookmark

The Dobot bookmark shows a distorted lower curved contour and poorly reproduced lettering (Fig. 8 (a)), whereas the intended outline and lettering are better preserved in the Prusa specimens (Fig. 8 (b)). These differences concern the visible reproduction of the model, not merely surface appearance. First-layer variation was reported during the trials, but its contribution to these contour errors was not separated from other process or mechanical factors.

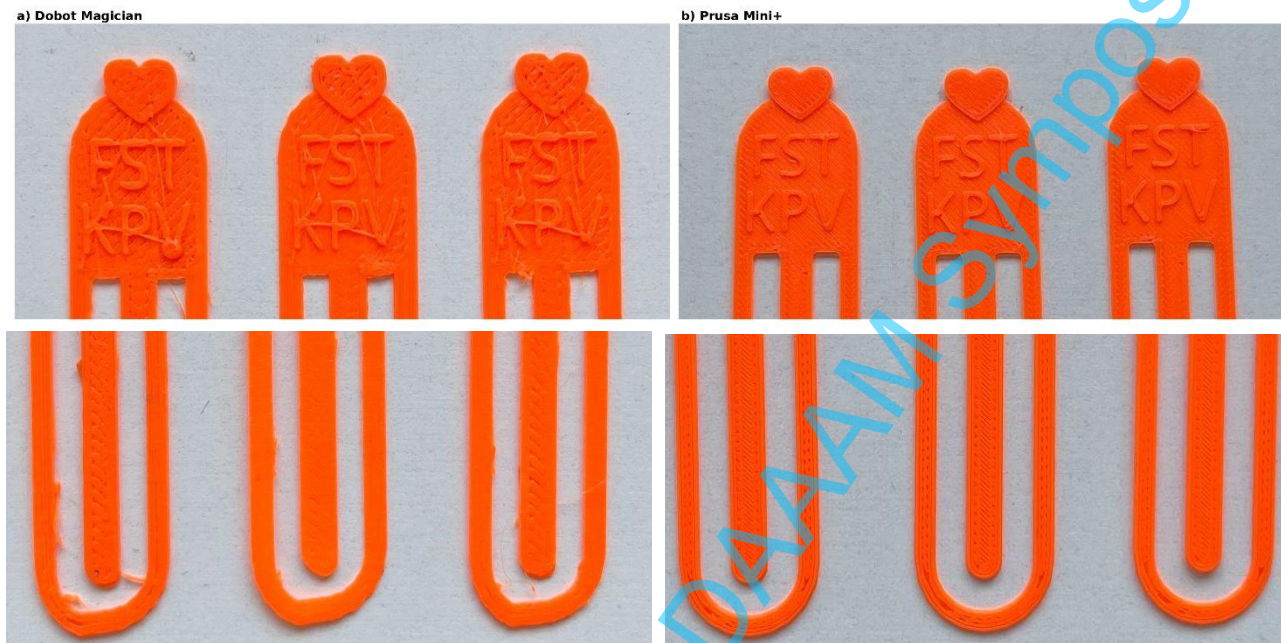


Fig. 8. Dobot Magician bookmark specimens detail (left), Prusa Mini+ bookmark specimens detail (right)

5.3. Keychain

The keychain photographs show the best results selected for each device rather than a complete record of all attempts. Both devices used the PLA supplied with the Dobot in this final comparison. The Prusa result (Fig. 9) preserves the internal shapes and gaps more clearly, while the Dobot result (Fig. 10) has visibly distorted geometry and poor separation of closely spaced features. Even this selected Dobot result does not demonstrate quality comparable to the Prusa specimen.



Fig. 9. Selected Prusa Mini+ keychain result using the PLA supplied with the Dobot.



Fig. 10. Selected Dobot Magician keychain result using the PLA supplied with the robot.

Across all three final models, the Prusa specimens exhibit better visible quality. The Dobot defects affect both basic contours and small details. Consequently, completion of the Dobot prints, including its selected best keychain, is not evidence of equivalent-quality replacement.

5.4. Additional filament observations

In our preliminary trials, the Dobot performed worse with the material labelled ‘PRUSA filament’ than with the supplied blue filament. There were more than six attempts without a good result and difficulties depositing material on the surface (Fig. 11). These preliminary attempts must not be confused with the later Prusament whistle and bookmark specimens. The Prusa also produced successful specimens using the blue Dobot filament in several preliminary profiles.



Fig. 11. Preliminary Dobot results with the material labelled “PRUSA filament”.

The recorded improvement with the supplied filament did not eliminate the Dobot’s geometric defects. Even with this filament, the selected Dobot keychain did not achieve visual quality comparable to the Prusa specimen. However, filament, first-layer setup and other settings were not controlled independently, so the observations do not establish a general incompatibility of a filament brand or a quantified material effect.

5.5. Printing time as a secondary result

Printing times were measured manually for both devices, from the start of filament deposition in the first layer to the end of filament deposition in the final layer. The measured interval excluded preheating and preparation before printing, as well as cooling and part removal after printing. During preliminary Dobot trials, estimated times displayed by RepetierHost of approximately 22 and 50 minutes corresponded to actual durations of just over 7 min and approximately 17 min, respectively. Table 4, therefore, presents manually measured elapsed times rather than software estimates.

Model	Dobot Magician	Prusa Mini+	Time difference (Dobot – Prusa)
Whistle	17 min	15 min	2 min
Bookmark	7 min	5 min	2 min
Keychain	8 min	7 min	1 min

Table 4. Recorded elapsed printing times for the final models. Differences are calculated directly from the recorded minute values.

The Prusa Mini+ had shorter recorded printing times for all three models, with differences of 1–2 min. Printing time is reported as a secondary result; the assessment of quality-equivalent replacement is based primarily on the visible quality of the printed specimens.

6. Discussion and further research

6.1. Comparable print quality and replacement

The answer to Research question 1 is no for the specimens and settings examined: the two devices did not print at a comparable level of quality. The Dobot specimens exhibit substantial visible defects in contours, holes, lettering, closely spaced features and upper surfaces, while the Prusa reproduces these features more faithfully. This conclusion follows

from the produced parts and photographs, including the simple geometric specimen and the final comparison of the same-filament keychain.

The answer to Research question 2 is also no for the best settings found in the performed trials: the tested Dobot configuration did not provide a quality-equivalent replacement for the Prusa Mini+ for the evaluated FFF tasks. Visible defects persisted in completed Dobot specimens at the selected setting.

The negative replacement result does not contradict Csekei et al.'s finding of comparable Dobot quality in some cases [17]. Their study used different reference printers and optical metrology, whereas the present study uses the Prusa Mini+ and qualitative visual assessment. The studies, therefore, do not evaluate the same quality requirement under the same conditions. These differences limit direct comparison; they do not, by themselves, explain the different findings.

6.2. Robot positioning accuracy and structural stiffness

The working interpretation is that limited positioning accuracy at the printing nozzle and insufficient stiffness of the robot's mechanical structure, including its frame and arm, may contribute to the observed geometric defects. This interpretation is motivated by the persistent failure to reproduce intended circular features, straight edges and small separations in completed Dobot specimens.

No independent nozzle-path measurement, tool-positioning accuracy test, structural-deflection measurement or frame-stiffness test is documented. Accordingly, the data do not demonstrate that the robot frame is insufficiently stiff, that positioning accuracy is the dominant cause, or that either mechanism explains the upper-layer defects. First-layer setup, extrusion behaviour, temperature, filament and the selected motion settings remain alternative or interacting explanations. Their relative contributions cannot be ranked from the photographs and operational observations alone. In particular, the upper-layer gaps observed in the Dobot whistle and bookmark specimens (Figs. 6 and 8) may also be related to inconsistent extrusion or insufficient thermal control, rather than motion inaccuracies alone.

6.3. Limits of the comparison

The analysis is based on qualitative comparison of the printed specimens. Settings were selected independently for each device, so the comparison does not isolate hardware effects. For the Dobot, obtaining a complete specimen was itself a practical challenge, and parameter adjustment often focused on overcoming first-layer failures and filament-feeding blockages rather than merely refining print quality. The final comparison used the best results achieved within the tested configurations. Some parameters used in the preliminary profile-based trials, as well as the total number of independent print attempts, were not fully recorded.

Nevertheless, a substantial difference in visual quality was observed between the tested specimens. The appropriate conclusion is therefore specific: the Dobot setup tested here was not a quality-equivalent substitute for the Prusa Mini+. The record does not establish the best quality achievable after untested modifications, nor does it support a conclusion about all robotic-arm printing systems.

6.4. Targeted follow-up tests

Further work should directly test the proposed mechanical explanation. A suitable follow-up would independently measure the nozzle path during commanded straight and circular motions with the printing equipment mounted, and measure tool displacement under known loads to assess the effective stiffness of the robot structure. Such tests would separate measured motion and deflection from inferences drawn from deposited material. These measurements are proposed here; they were not part of the reported experiment.

Subsequent repeated printing trials should document the complete settings and actual temperatures, use the same filament for a given model, establish first-layer conditions, and quantify the dimensions and surface defects relevant to the replacement requirement. Changing mechanical conditions separately from extrusion and first-layer settings would help test their individual effects. Whether calibration changes or mechanical modifications close the quality gap must be demonstrated by new specimens rather than assumed in advance.

7. Conclusion

At the best settings found for each device in the trials conducted, the Dobot Magician did not achieve FFF print quality comparable to that of the Prusa Mini+. The Prusa specimens better preserved the intended geometry, lettering, small features and surface continuity. The Dobot retained visibly inferior contours, hole geometry, fine-detail separation and upper-layer quality. The tested configuration also required repeated manual commissioning before a complete specimen could be obtained, whereas the reference printer produced usable specimens directly from predefined profiles.

At these settings, the Dobot Magician therefore did not provide a quality-equivalent replacement for the Prusa Mini+ for the evaluated printing tasks. This conclusion is based primarily on the quality of the produced specimens. Longer recorded print times and more demanding operations are additional disadvantages, not the decisive evidence.

Limitations in robot positioning accuracy and structural stiffness may explain the gap in geometric quality, but the experiment did not measure them or isolate their contributions. The conclusion is limited to the tested devices, settings and models, and does not claim a general limit for robotic additive manufacturing.

8. Acknowledgements

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