Rags2Riches: Computational Garment Reuse Supplemental Materials

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1 Online tutorials on garment reuse

In Table 1 we provide a list of online tutorials that inspired our design principles for garment reuse. We have reported, for each video, the time step when some interesting and impactful operation highlights certain aspects of our choices regarding our strategy.

2 User control

Users can specify which parts of the source should or should not be reused. In Figure 1(a), the user indicates that one skirt panel should be excluded from the reused plan. In practice, we do not slide the target panels over the excluded area when generating candidates (Sec. 4.1.1).

Conversely, in Figure 1(b), the user highlights a specific segment of the seam to be included in the reused plan. To enforce this preference, we assign a high seam reuse value (−10 compared to the default value −4) to the corresponding seam edges, encouraging their inclusion in the final result.

We also implemented an optional fragmentation cost to reduce waste by penalizing the use of multiple source panels. For each source panel s_k, we define an auxiliary binary variable $\mathbf{x_k}$ that indicates whether its polyomino approximation $\hat{s}_k$ is occupied by any candidate assignment across all target panels. Specifically, $\mathbf{x_k}$ is set to the maximum value among all candidates $c_m \in C_{ik}$ across all target panels t_i:

$$\mathbf{x_k} = \max_{i,\, c_m \in C_{ik}} \mathbf{c_m}. \tag{1}$$

The final cost combines Equation 6 with the fragmentation cost:

$$\begin{aligned} F \;=\; & \sum_{\hat{t}_i} \sum_{\hat{s}_k} \sum_{c_m \in C_{ik}} \mathbf{c_m} \Big[\lambda_{\text{Deform}} F_{\text{Deform}}(c_m) \\ & + \lambda_{\text{Fabrication}} \Big(F_{\text{Cut}}(c_m) + F_{\text{Sew}}(c_m) \\ & + \sum_{\hat{t}_{j\neq i}} \sum_{\hat{s}_l} \sum_{c_n \in C_{jl}} \mathbf{b_{mn}} F_{\text{Reuse}}(c_m, c_n) \Big) \Big] \\ & + \sum_{\hat{s}_k} \lambda_{\text{Fragment}} \mathbf{x_k}. \end{aligned} \tag{2}$$

We show in Figure 1(c) that with this additional cost, the reused pattern concentrates on two source panels, in contrast to the more dispersed reuse across multiple panels in (a) and (b).

3 Detailed parameters and timings

Table 2 details the computation time for the main steps of our algorithm, for all results, along with the parameters used. For each result, we provide timings for the initial low resolution solution (scale < 1) and for the high-resolution refinement (scale = 1). The most expensive steps are the computation of the pairwise term F_{Reuse} and solving the optimization at low resolution, which varies from a few minutes for simple examples (skirt to hat, dress to skirt) to more than 20 minutes for the most complex examples (top to dog coat, dress to top). In contrast, high-resolution refinement typically takes less than a minute, which can allow users to perform a few iterations of parameter tuning.

4 Algorithm Performance vs. Target/Source Size Ratio

We progressively scaled the target of Case 2 (pants to bag) to assess the behavior of our algorithm in relation to relative target and source sizes. In Table 3 we provide the values for cost functions and the computation time at low resolution. The algorithm achieves less reuse and yields higher deformation as the ratio of target area over source area increases, up to the point where the optimization does not find any feasible solution. The computation time is more affected by the ratio of the area between the target and source panels than by the number of panels. The optimization has more candidates to consider when the ratio is small, thus, it requires more time to solve. For instance, as shown in Table 3, a target/source area ratio of 0.36 takes 1152 seconds to solve, whereas a ratio of 0.64 takes only 63 seconds. In Figure 2, we visualize an example with a larger number of panels – 10 in the source and 10 in the target – which is solved in just 176 seconds.

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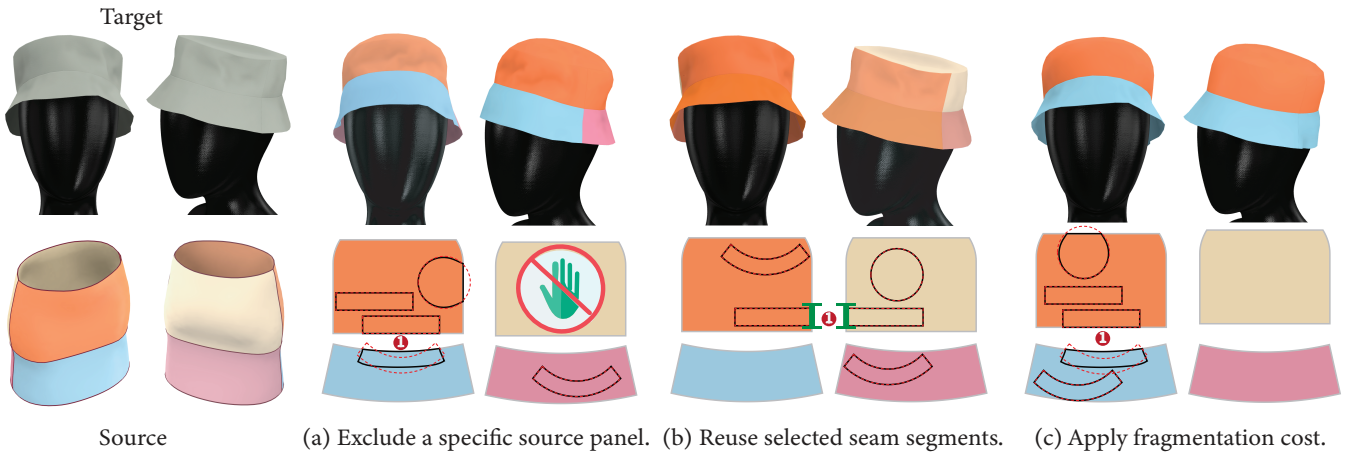

Fig. 1. Our formulation readily accommodates additional user preferences. As illustrated: (a) the user can forbid reuse of a specific panel (marked with a forbidden sign); (b) prefer reuse of selected seam segments (highlighted in green); and (c) apply an additional fragmentation cost to concentrate reuse on fewer panels. The results were obtained using $\lambda_{\text{Fabrication}} = 75$, $\lambda_{\text{Deform}} = 2000$, and $\lambda_{\text{Fragment}} = 40$ in (c).

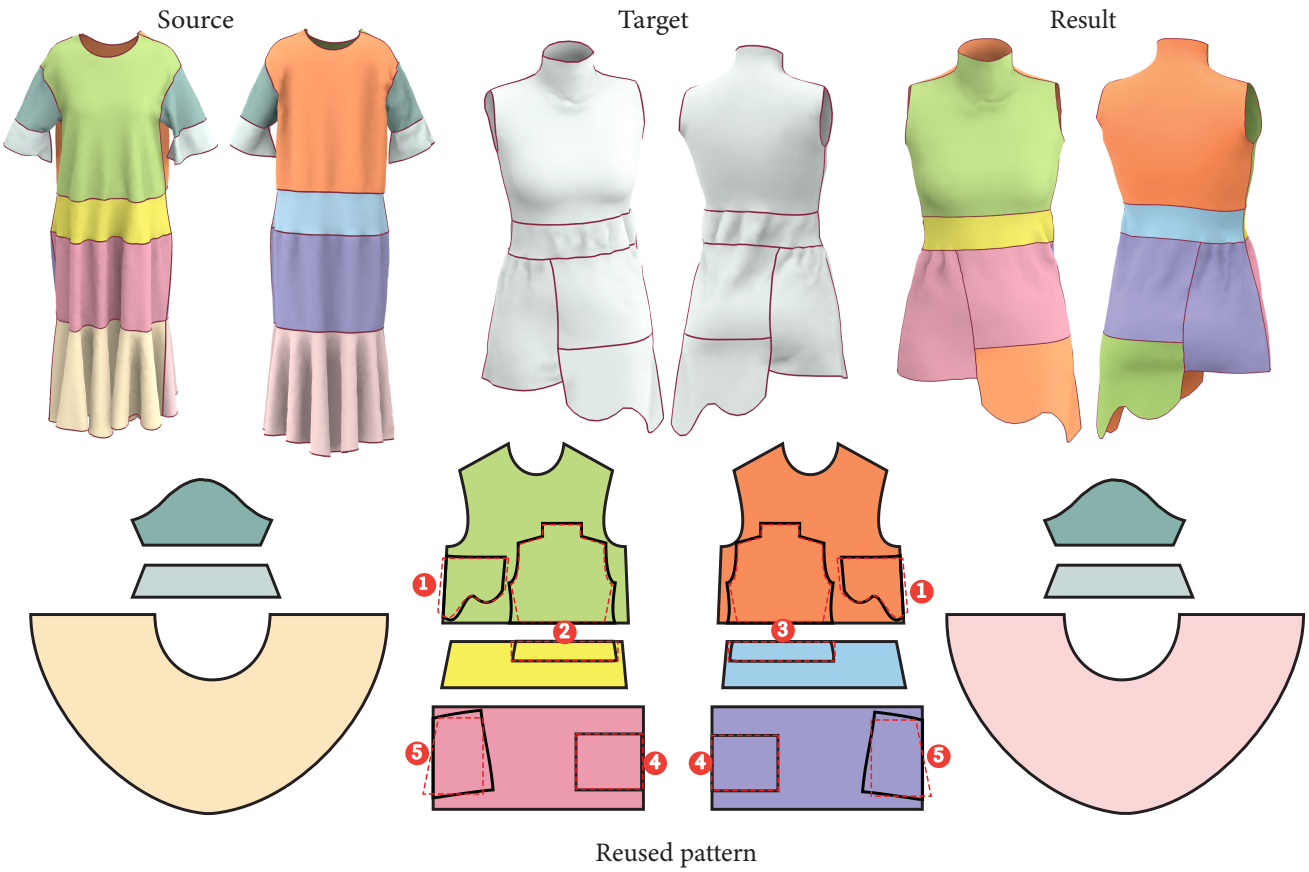

Fig. 2. Result on the source and target with more panels (10 panels in both source and target). Despite the large number of panels, it takes only 176s to solve.

5 Results in polyomino space

We visualize in Figure 3, 4 and 5 the solutions found by our algorithm in polyomino space (low and high resolution), for all our results.

Table 1. Online tutorials on garment reuse that inspired our design principles and examples.

Ref	Title	Author	URL	Time of reuse operation
T1	Upcycle Jeans into DOPE Denim Tank	Orly Shani	Youtube link	2:30, seam reuse
T2	DIY Jeans to Crop Top Upcycle + Mother's Day Surprise	BlueprintDIY	Youtube link	2:50, hem reuse
T3	How to sew a great vest out of old jeans simply!	Miarti Clever Sewing	Youtube link	0:30, seam reuse
T4	old jean into a pleated skirt	fashion_deity	Instagram link	-
T5	DIY Easy Dog Tshirt from a Pant/Legging	HomeStyle Little Things	Youtube link	0:20, hem reuse
T6	Alter human shirts to fit a dog's body	susan_k	Instructables link	-
T7	DIY old jeans into front ruffle top	Nilofer Khan	Youtube link	0:58, seam reuse
T8	Make a unique and cute pumpkin bag	SEWINGTIPS	Youtube link	0:36, seam reuse
T9	Refashion DIY Denim set from old jeans	AssunDIY	Youtube link	4:20, seam reuse

Table 2. Detailed parameters and timings for all our results, for the initial low-resolution solution (scale < 1) and for the high-resolution refinement (scale $= 1$).

Result	$\lambda_{\text{Fabrication}}$	λ_{Deform}	Scale	Quantization	Candidate generation	Nbr. of candidates	Pairwise bonus term	Solve	Total
Top to dog coat (Fig.1)	75	400	0.4	0.96s	0.63s	1833	299s	1264s	1565s
	75	400	1	1.58s	1.5s	229	95s	0.67s	99s
Skirt to hat (Fig.8)	75	1850	0.4	0.67s	0.38s	1532	94s	65s	160s
	75	1500	1	0.9s	0.84	149	19s	0.26s	21s
Pants to bag (Fig.7)	75	500	0.25	1.47s	0.52s	1108	98s	247s	347s
	75	500	1	3.63s	3.88s	281	86s	0.39s	94s
Dress to skirt (Fig.7)	75	100	0.35	0.15s	0.3s	785	37.6s	15.9s	54s
	75	0	1	0.20s	1.06s	52	10.42s	0.065s	12s
Dress to top (Fig.7)	75	500	0.375	0.57s	0.47s	2673	199s	1473s	1673s
	75	500	1	0.98s	1.3s	520	167s	11.8s	181.5s
Pants to top (Fig.4)	75	50	0.25	0.74s	0.29s	680	26s	16.4s	43s
	75	75	1	1.49s	0.78s	141	90s	0.64s	93s
Pants and skirt to top (Fig.10)	75	300	1	1.31s	0.73s	822	92s	40s	134s
Skirt to top and midi skirt (Fig.10)	75	300	0.5	1.08s	0.61s	1050	111s	28.6s	141s
	75	0	1	2.55s	1.22s	121	102s	0.95s	106s

Table 3. Detailed cost values and computation times for different target scales in Case 2: pants to bag (Fig. 7).

Target Scale (length)	Target/source area ratio	Cutting + Sewing cost	Seam reuse	Deformation cost	Final objective	Nbr. of candidates	Total time (low resolution)
0.9	0.36	-673	920	-27	220	1744	1152
0.95	0.40	-667	911	-31	57	1536	630
1.0	0.45	-612	699	-30	213	1108	347
1.05	0.49	-626	710	-41	43	1012	224
1.1	0.54	-552	632	-47	33	964	216
1.15	0.59	-619	615	-40	-44	624	76
1.2	0.64	-621	616	-44	-49	576	63
1.25	0.7	No Solution Found					

Figure 1: top to dog's coat

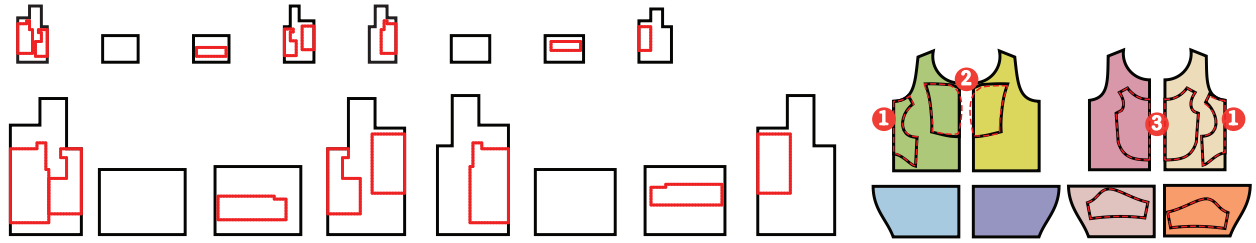

Figure 4: pant to top

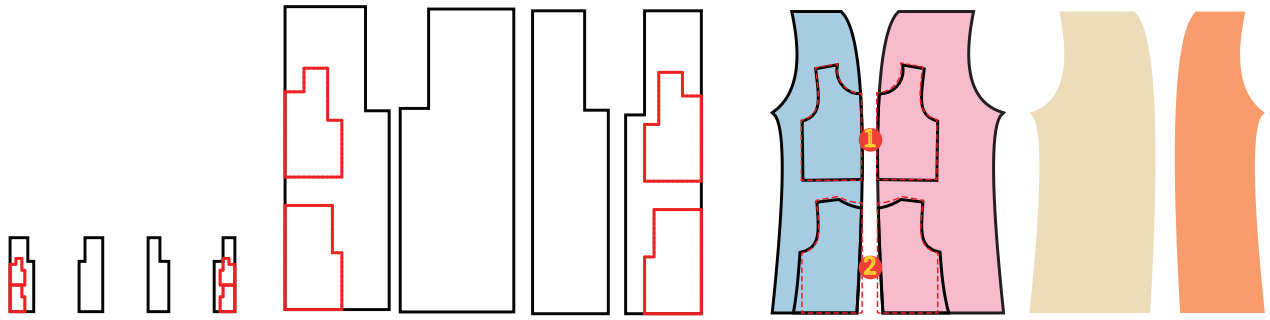

Figure 7, case 1: dress to top

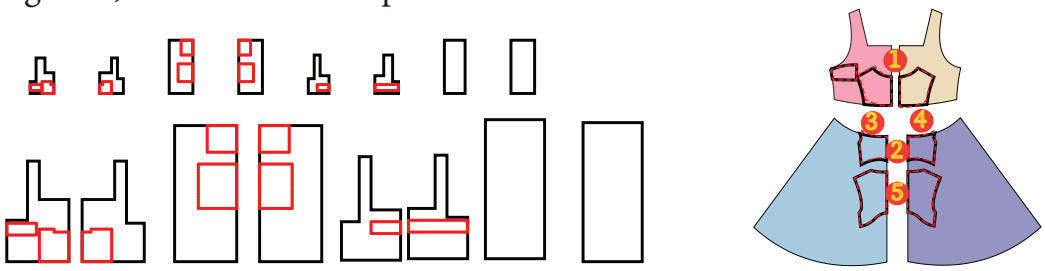

Figure 7, case 2: pant to bag

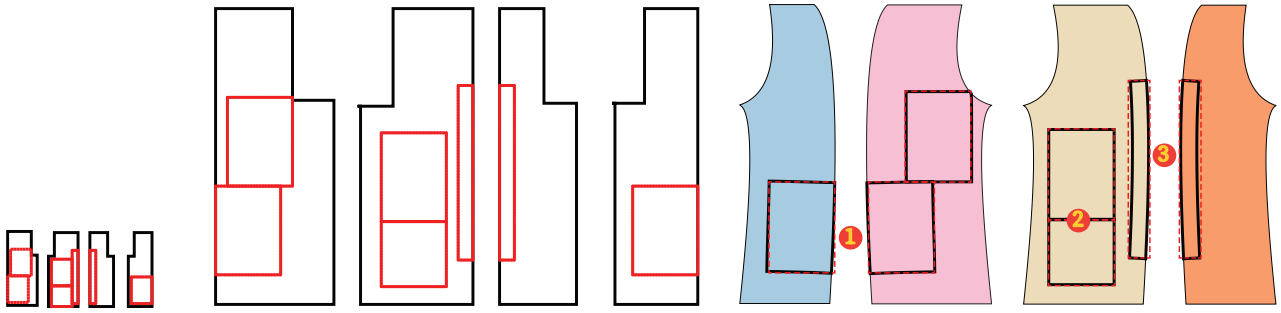

Fig. 3. Visualization of the intermediate solutions in polyomino space, at low and high resolution.

Figure 7, case 3: dress to skirt

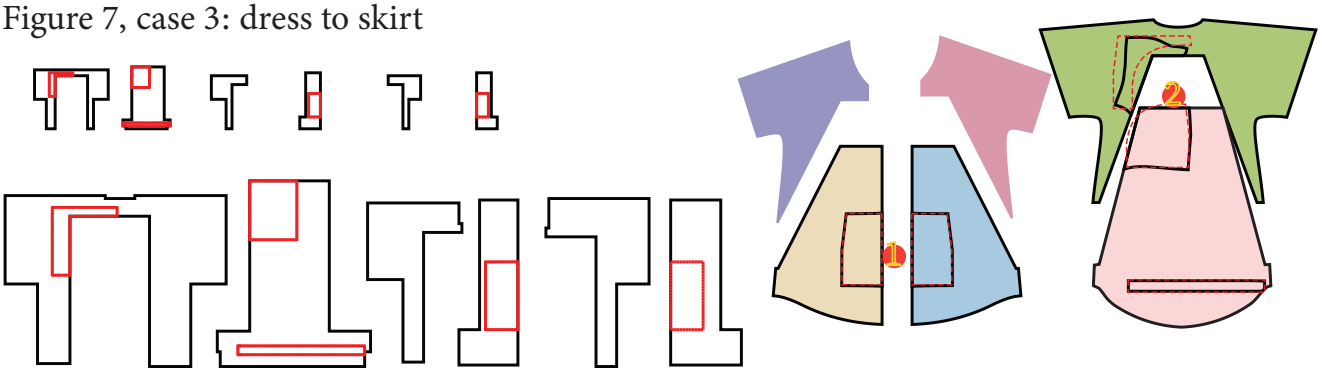

Figure 8: skirt to hat

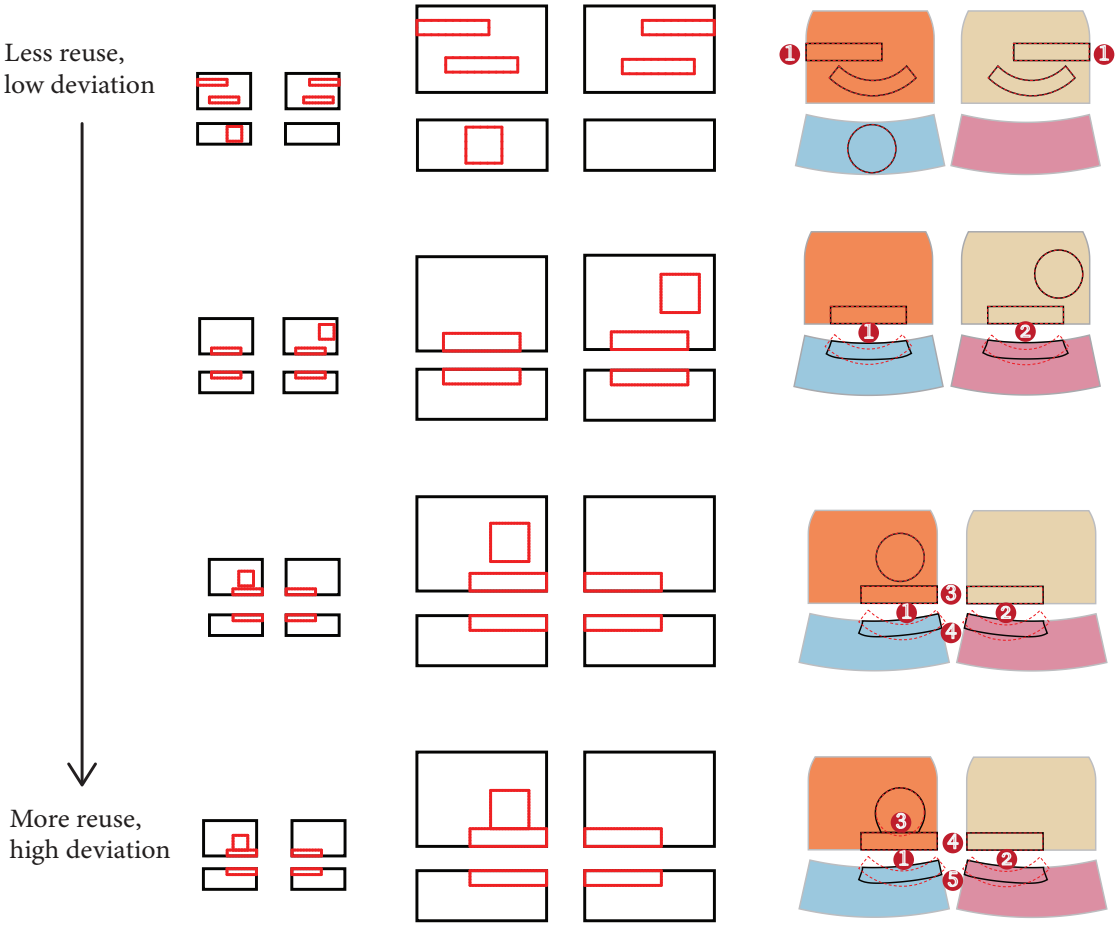

Fig. 4. Visualization of the intermediate solutions in polyomino space, at low and high resolution.

Figure 9: top to dog's coat

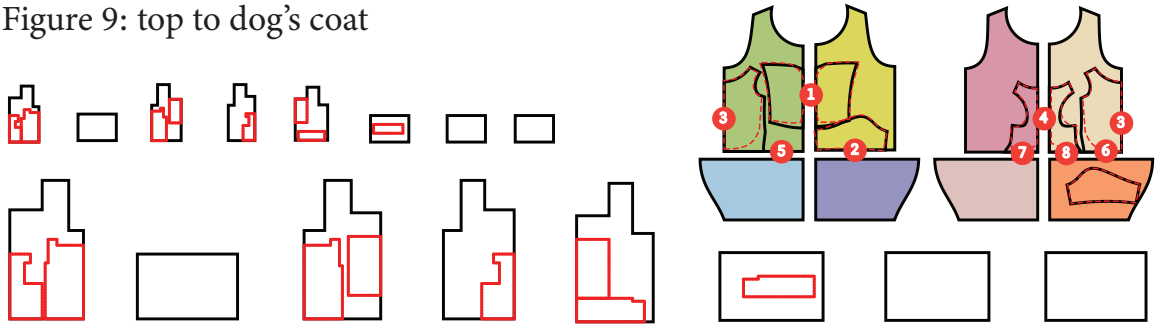

Figure 10, case 4: pant and skirt to top

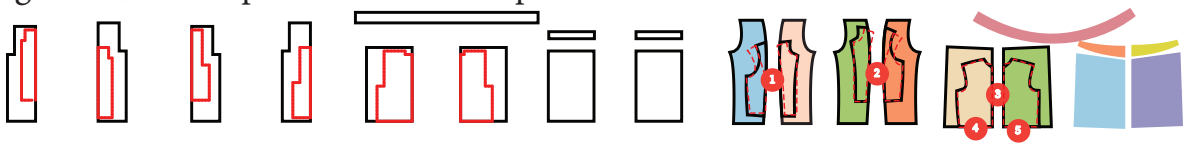

Figure 10, case 5: circle skirt to top and midi skirt

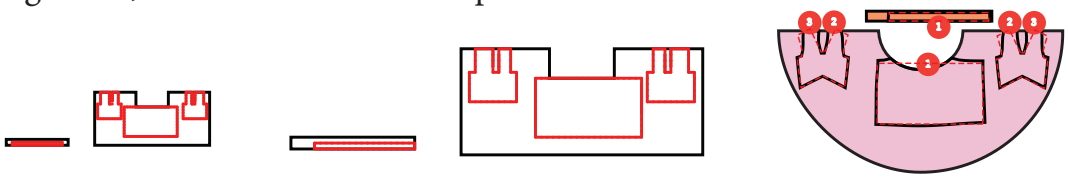

Fig. 5. Visualization of the intermediate solutions in polyomino space, at low and high resolution.