# The Supplemental Material for "Attribute2Font: Creating Fonts You Want From Attributes"

YIZHI WANG<sup>\*</sup>, Wangxuan Institute of Computer Technology, Peking University, China YUE GAO<sup>\*</sup>, Wangxuan Institute of Computer Technology, Peking University, China ZHOUHUI LIAN<sup>†</sup>, Wangxuan Institute of Computer Technology, Peking University, China

In this document, we provide additional experimental results in support of the conclusions drawn in the primary text. The figures to be presented and their corresponding subjects are listed as follows:

- Fig. 1 and Fig. 2 show how the pixel loss  $l_{pixel}$  (namely L1 loss) varies with the training steps and the validation steps.  $l_{pixel}$  is an important metric that evaluates our model's performance of accurately reconstructing the target glyphs (lower is better). We calculate our model's L1 loss on the validation dataset every 400 training steps. We randomly select 28 fonts from the labeled fonts and match them for the 28 fonts in the validation dataset. All models in Fig. 2 use the same source fonts for fair comparison. We can see that the loss curve elevates dramatically with the removal of skip-connection from our model. Both the AAM and the VST boost our model's performance in a significant degree.
- Fig. 3: the effect of the choice of source font in the inference stage.
- Fig. 4: the impacts of different modules in our model.
- Fig. 5: generating Chinese fonts from attributes.
- Fig. 6, 7, 8 and 9: generating English and Chinese glyph images by interpolation between the attribute values of two different fonts.
- Fig. 10, 11, 12 and 13: editing English Chinese fonts by changing the value of a single attribute.
- Fig. 14 and 15: comparison of our model and existing methods of attribute-controllable image synthesis, including AttGAN [He et al. 2019], StarGAN [Choi et al. 2018], RelGAN [Wu et al. 2019] and STGAN [Liu et al. 2019].
- Fig. 16: comparison of our model and two existing font retrieval methods ( [O'Donovan et al. 2014] and [Chen et al. 2019]).
- Fig. 17: comparison of StarGAN+AAM and StarGAN.
- Fig. 18: the glyph images of a whole char-set generated by our method from random attribute values.
- Fig. 19: some continuous texts rendered by our model's generated fonts.

#### REFERENCES

Tianlang Chen, Zhaowen Wang, Ning Xu, Hailin Jin, and Jiebo Luo. 2019. Large-scale Tag-based Font Retrieval with Generative Feature Learning. In *ICCV*. 9116–9125.

\*Denotes equal contribution †Corresponding author

Authors' addresses: Yizhi Wang, Wangxuan Institute of Computer Technology, Peking University, China, wangyizhi@pku.edu.cn; Yue Gao, Wangxuan Institute of Computer Technology, Peking University, China, gerry@pku.edu.cn; Zhouhui Lian, Wangxuan Institute of Computer Technology, Peking University, China, lianzhouhui@pku.edu.cn.



Fig. 1. The L1 losses of our models with different configurations in the training process.



Fig. 2. The L1 losses of our models with different configurations in the validation process.

- Yunjey Choi, Minje Choi, Munyoung Kim, Jung-Woo Ha, Sunghun Kim, and Jaegul Choo. 2018. Stargan: Unified generative adversarial networks for multi-domain image-to-image translation. In CVPR. 8789–8797.
- Zhenliang He, Wangmeng Zuo, Meina Kan, Shiguang Shan, and Xilin Chen. 2019. Attgan: Facial attribute editing by only changing what you want. *IEEE Transactions* on *Image Processing* (2019).
- Ming Liu, Yukang Ding, Min Xia, Xiao Liu, Errui Ding, Wangmeng Zuo, and Shilei Wen. 2019. STGAN: A Unified Selective Transfer Network for Arbitrary Image Attribute Editing. In CVPR. 3673–3682.
- Ziwei Liu, Ping Luo, Xiaogang Wang, and Xiaoou Tang. 2015. Deep Learning Face Attributes in the Wild. In *ICCV*.
- Peter O'Donovan, Jänis Libeks, Aseem Agarwala, and Aaron Hertzmann. 2014. Exploratory font selection using crowdsourced attributes. ACM Transactions on Graphics (TOG) 33, 4 (2014), 92.
- Po-Wei Wu, Yu-Jing Lin, Che-Han Chang, Edward Y Chang, and Shih-Wei Liao. 2019. Relgan: Multi-domain image-to-image translation via relative attributes. In *ICCV*. 5914–5922.

	artisti	с		calı	m			deli	cate		form	al	gent	le	ital	ic		pla	yful		S	oft		war	m
attribute																									
ground truth	аb АВ	c C	d D	e E	f F	g G	h H	i 	j J	k K	l L	m M	n N	0 0	р Р	q Q	r R	s S	t T	u U	v V	w W	x X	y Y	z Z
source input 1	аb АВ	с С	d D	e E	f F	g G	h H	i I	j	k K	l L	m M	n N	о О	р Р	q Q	r R	s S	t T	u U	v V	w W	x X	y Y	z Z
output 1	ab AB	c C	d D	e E	f F	g G	h H	i 	j	k K	 L	m M	n N	0 0	р Р	q Q	r R	s S	t T	u U	v V	w W	x X	y Y	z Z
source input 2	a b A B			e E	f F	9 G	h H	i I	ر ر ب	k K	L	т М	п N		P P	Р С	г R	s S	t T	U U	V V	W W	X X	y Y	z Z
output 2	a b A B	C C	d D	e E	f F	g G	h H	i 	J	k K	l L	m M	n N	0 0	p P	q Q	r R	s S	t T	u U	V V	W W	X X	y Y	z Z
source input 3	a b A B	C	d D	e E	t F	9 6	h H	   	J J	k K	1	M	n N	0	P P D	<b>q</b> <b>Q</b>	r R	55	† 1	Ű	V	W	X X	Y Y	z 2
output 3	a d A B	C	D D	E	F	G G	n H		J	K	L	M	N	0	p	Q Q	r R	S	T T	U	v V	W	X X	Y Y	Z
source input 4	чь АВ	C	d D	E	J F	s G	h H	ı I	J	k K	l L	m M	n N	0	r P	ı Q	' R	s	і Г	u U	v	w	x	Y	ž
output 4	аb AB	c C	d D	e E	f F	S G	h H	i I	j J	k K	l L	m M	n N	0 0	р Р	q Q	r R	s S	t T	u U	v V	w W	x X	y Y	z Z
	artisti	с		calı t	m			deli	cate		i	fresh			ital	ic		pla	yful		S	oft		wari	m
attribute	artisti	c		calı †	m			deli	cate		t	fresh			ital	ic		pla	iyful ↑		S	oft 1		wari †	m
attribute ground truth	artisti a b A B	C C	d D	cah 1 e E	n f F	g G	h H	delia i I	j J	k K	1 L	fresh 1 m M	n N	0 0	ital 1 <b>P</b> <b>P</b>	<sup>ic</sup> q Q	r R	pla S S	t T	u U	s V V	oft 1 W	x X	warn ↑ <b>Y</b> Y	n Z Z
attribute ground truth source input 1	artisti a b A B a b A B	с С С С	d D D	e E E	f f f f	<b>B G</b> g G	h H H	delia i I <i>I</i> <i>I</i>	j j j j	<b>k</b> <i>K</i> <i>K</i> <i>K</i>	1 L <i>I</i>	m M M M	n N N	<b>o</b> <b>O</b> <i>O</i>	ital P P P	ic <b>q</b> Q Q	r R R	pla S S S	t T T T	<b>u</b> <i>u</i> <i>U</i>	s V V V	w W W W	x X X X	warn ↑ <b>Y</b> Y Y Y	π <b>z</b> Ζ Ζ Ζ
attribute ground truth source input 1 output 1	artisti a b A B a b A B a b A B a b		d D d D d D	e e e e e e e e e e e e e e e e e e e	f f f f f f f f f f f f f f f f		hH hH hH	delia i I I I I I	j j j j j j	<b>k</b> K <i>k</i> K <b>k</b> K <b>k</b> K	1 L / L 1 L	m m M m M m M m M	n N n N n N	0 0 0 0 0 0	ital PPPPPPPPP	ic <b>q</b> Q Q Q Q Q Q	r R r R r R r R	pla S S S S S S S	t T t T t T	<b>u</b> <i>U</i> <i>U</i> <i>U</i> <i>U</i>	s V V V V V V	W W W W W W	x x x X x X x X	wari Y Y Y Y Y Y	m <b>Z</b> Z Z Z Z Z Z
attribute ground truth source input 1 output 1 source input 2	artisti a b A b			e E e E e E e E e E e E e E e E e E e E	f f f f f f f f f f f f f f f f f f f		hH hH hH hH h	i i i i i i i i i	j j j j j j j j j j	kK kK kK kK k	1 L L L L L L L	m M M M M M M M M M M M	n N n N n N n N n N n N n N n N n N n N	0 0 0 0 0 0 0 0 0 0 0 0 0	<sup>ital</sup> <b>РРРРРР</b> РРРРРР		r R r R r R r R r R r R r R	s S S S S S S S S S S S S S S S S S S S	t T t T t T t T t T		s V V V V V V V V V V V V	W W W W W W W W	x x x x x x x x x x x x x x x x x x x	V V V V V V V V V V V V V V	
attribute ground truth source input 1 output 1 source input 2 output 2	artisti a b A B		dD dD dD dD dD	e E e E e E e E e E e E e E e E e E e E	<b>fF</b> <i>f</i> <b>FffFfffffffffffff</b>	<b>BG</b> 20 C 20	hH hH hH hH hH	delia i I i I i I i I i I	j j j j j j j j j j j j j j j j	<b>kK</b> kK kK kK	1 L 1 L 1 L 1 L 1 L	m M M M M M M M M M M M M M M	nNnNnNnNnN		PPPPPPPPPPPPPP		r R r R r R r R r R r R	s S S S S S S S S S S S S S S S S S S S	t T t T t T t T t T t T t T t T	u U u U u U u U u U u U u U	s V V V V V V V V V V V V V V V	w W W W W W W W W W W W W W	x X x X x X x X x X x X x X	warn Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	$\mathbf{Z} \mathbf{Z} \mathbf{Z} \mathbf{Z} \mathbf{Z} \mathbf{Z} \mathbf{Z} \mathbf{Z} $
attribute ground truth source input 1 output 1 source input 2 output 2 source input 3	artisti a b A B			e E e E e E e E e E e E e E e E e E e E	<b>fF</b> <i>f</i> <b>FffFffFffFfffffffffffff</b>		hH hH hH hH hH hH	deliv i i i i i i i i i i i i i i i	j j j j j j j j j j j j j j j j j j j	KK kK kK kK kK		m m m m m m m m m M m M m M m M m M m M	n N n N n N n N n N n N n N n N n N				r R r R r R r R r R r R r R	s S S S S S S S S S S S S S S S S S S S		u U u U u U u U u U u U u U u U u U u U	s V V V V V V V V V V V V V V V V V V V	w W W W W W W W W W W W W W W W	x X x X x X x X x X x X X X X X X X X X	Variation of the second	
attribute ground truth source input 1 output 1 source input 2 output 2 source input 3 output 3	artisti a b A b			e E e E e E e E e E e E e E e E e E e E	<b>fF</b> <i>f</i> <b>FffFfFfFfFfFfFfFfFfFfFfFfFfFfFfFfFfFfffffffffffff</b>	BG BG BG BG BG BG BG	hH hH hH hH hH bH hH	i i i i i i i i i i i i i i i i i i i	j j j j j j j j j j j j j j j j j j j	<b>kK</b> kK kK kK kK kK		m m m m m m m m m m M m m M m M m M m M	nNnNnNnNnNpNnN				<b>rR</b> <i>r</i> <b>RrRrRrRrRrRrRrRrRrRrRrRrR</b>	s S S S S S S S S S S S S S S S S S S S		u U u U u U u U u U u U u U u U u U u U		W W W W W W W W W W W W W W W W W W W	XX	Variation V V V V V V V V V V V V V V V V V V V	
attribute ground truth source input 1 output 1 source input 2 output 2 source input 3 output 3	artisti a b b a b b a b b a b b a b b b b b b b					<b>80 80 80 90 80 90 80</b> 80 80 80 80 80 80 80 80 80 80 80 80 80	<b>hH</b> hH hH hH hH hH hH < H	delig i I i i i i i i i i i i i i i	jjjjjjjjjjj jjjjjjjj jj	$\blacksquare \mathbf{k}\mathbf{K} \times \mathbf{k}K$		m m m m m m m m m m m m m m m m m m m	<b>n</b> N n N n N n N n N n N n N n N n N n N				<b>r</b> RrRrRrRrRrRrR, 突	pla SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS			s VVVVVVVVVV V V V		XX	Y Y Y Y Y Y Y Y Y Y Y Y	

Fig. 3. Generating glyph images with the same target attribute values from different source fonts. The pixel value of each grayscale grid represents each attribute's value. A darker grid indicates a higher attribute value. In the following figures we use the same way to display attribute values.

	angular		bori	ng		clum	sy d	elic	ate	f	orm	al	gent	le	itali	c m	onos	pace	ser	if	sc	ft		v	vide
attribute																									
w/o SL	a b H B	C C	d D	e E	f F	g S	b H	i l	j J	k K	l L	m M	n N	0 0	P P	q O	r R	9 S	t T	u U	v V	เง W	x X	y Y	Z Z
w/o SC	a b A B	ε C	d D	e E	f F	g G	h H	i I	i J	k K	 (	m N	n N	0 0	ր P	<b>A</b> 0	ľ R	s S	t T	<b>0</b> U	v U	W W	X X	₩ Y	z Z
w/o VST	a b A B	c C	d D	e f	f f	0 G	h H	i 	i J	k K	1 C	m N	n N	0 0	р Р	q Q	r R	s S	t T	u U	u V	w W	x X	У Ү	z Z
w/o AAM	a b A B	C C	d D	e E	f F	g G	h H	i I	j J	k K	l L	m M	n N	0 0	р Р	q Q	f R	s S	t T	U U	v V	W	x X	y Y	z Z
Full Attr2Font	ab AB	C C	d D	e E	f F	g G	h H	i I	j J	k K	l L	m M	n N	0 0	р Р	q Q	r R	s S	t T	u U	v V	w W	x X	У Ү	z Z
ground truth	аb АВ	c C	d D	e E	f F	g G	h H	i I	j J	k K	l L	m M	n N	0 0	р Р	q Q	r R	s S	t T	u U	v V	w W	x X	у ү	z Z
attribute																									
w/o SL	a b A B	C C	d D	e E	F F	g G	h H	1 1	j J	<b>k</b> K	l L	m M	n N	0 0	p P	<b>q</b> Q	r R	s S	t T	u U	v V	w W	X X	y Y	z Z
w/o SC	a b A B	с С	d D	e E	f F	g G	h H	i I	j J	k K	l L	m M	n N	о О	р <b>Р</b>	q Q	r R	s S	t T	u U	v V	w W	x X	y Y	z Z
w/o VST	a b A B	C C	d D	e E	f F	g G	h H	i I	1 1	k K	L	m M	n N	0 0	p P	q O	r R	s S	t T	u U	v V	w W	x X	У Ү	z Z
w/o AAM	a b A B	C	d D	e E	f F	9 G	h H	ĺ	J	k K	L	m M	n N	0 ()	P P	q Q	r R	s S	t T	u U	V V	W W	X X	y Y	z Z
Full Attr2Font	a b A B		d D	e E	f F	g G	h H	İ	] ]	k K	L	m M	n N	0 0	P P	q Q	r R	S S	t T	u U	V V	W W	X X	Y Y	Z Z
ground truth	a b A B		d D	e E	f F	g G	h H	İ	] ]	k	L	m M	n N	0 0	P P	q Q	r R	S S	t T	u U	V V	W	X X	Y Y	z Z
attribute																									
w/o SL	аь АВ	c C	d D	e E	f F	g G	h H	i	j J	k K	1 L	m M	n N	0 0	р Р	<b>q</b> 0	r R	s S	t T	u U	v V	<b>w</b> '/\	x X	<b>у</b> Ү	z Z
w/o SC	a b A B	C C	d D	e E	f	g G	b H	i 	]	k K	L	m M	n N	0 0	р Р	q Q	r R	s S	t T	U U	V V	W	<b>х</b> Х	y Y	z Z
w/o VST	a b A B	C C	d D	e E	f	g G	h H	I	J	k K	L	m M	n N	0 0	р Р	q O	r R	s S	t T	u U	V V	W W	X X	у Ү	z Z
w/o AAM		C C	d D	e E	t F	В G	h H	1	] ] ;	k K	I L	m M	n N	000	Р Р	Q	r R	s S	t T	U U	V V	W	X X	y Y V	ZZ
Full Attr2Font	a b A B		d D	e E	t F	Б G С	n H	1 1	] ]	K K	I L J	M	n N r	0000	Р Р	Ч Q C	r R	s S c	T T	u U	VV	W	X X	y Y V	Z
ground truth	a c A E		a D	е Е	г F	у G	n H	l I	J J	к К	Т Г	M	n N	0	Р Р	Ч Q	г R	S	с Т	u U	V V	W W	x X	у Ү	Z

Fig. 4. The glyph images generated by our models with different configurations. w/o denotes without. "SL", "SC", "VST" and "AAM" denote semi-supervised learning, skip-connection, Visual Style Transformer and Attribute Attention Module, respectively.

	angular	boring	clumsy	delicate	formal	gentle	italic mono	space serif	soft	wide
attribute										
Attr2Font	爱凹敖	奥扒ハ	爸白	拜帮智	官卑本	甭比	必辟臂	变卞虎	<b>斌</b> 濒秉	博勃
ground truth	爱凹敖	奥扒八	爸白	拜帮智	包卑本	: 甭比	必辟臂	变卞彪	总斌濒秉	.博勃
Attr2Font	电刁丁	鼎定东	兜斗	段断电	页而儿	二贰	发乏返	泛方了	* 丰弗甫	斧腐
ground truth	电刁丁	鼎定东	兜斗	段断曲	反而儿	二贰	发乏返	泛方飞	山丰弗甫	斧腐
Attr2Font	不裁才	残曹产	长畅	,掣彻目	巨成承	匙迟	尺翅斥	丑出矗	i 处 川 串	大带
ground truth	不裁才	残曹产	长畅	) 掣彻目	巨成承	匙迟	尺翅斥	五出盘	处川串	大带
							_		_	
attribute										
Attr2Font	爱凹敖	奥扒八	、爸白	拜帮智	国卑本	甭比	必辟臂	变下虎	赵斌濒秉	博勃
ground truth	爱凹敖	奥扒八	爸白	拜帮着	<b> </b>	. 甭比	必辟臂	变卞虎	赵斌濒秉	博勃
Attr2Font	电刁丁	鼎定东	兜斗	·段断亚	而儿	二贰	发乏返	泛方飞	三十二年二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十二十	i斧腐
ground truth	电刁丁	鼎定东	兜斗	·段断亚	页而儿	二贰	发乏返	泛方飞	「丰弗甫	斧腐
Attr2Font	不裁才	残曹产	长畅	j掣彻B	E成承	匙迟	尺翅斥	田出矗	「 於 川 隼	大带
ground truth	不裁才	残曹产	长畅	<b>j</b> 掣彻日	巨成承	匙迟	尺翅斥	五出矗	。处川串	大带
attribute										
Attr2Font	爱凹敖	奥扒八	爸白	拜帮誓	包卑本	甭比	必辟臂	变卞彪	总斌濒秉	博勃
ground truth	爱凹麸	奥扒バ	爸白	拜帮智	宽卑奉	甭比	必辟臂	变个虑	总斌濒秉	博勃
Attr2Font	电刁丁	鼎定东	兜斗	段断剪	页而儿	二贰	发乏返	泛方飞	丰弗甫	斧腐
ground truth	电刁丁	鼎定东	兜斗	·段断剪	页而几	二贰	发乏返	泛方飞	、丰弗甫	斧腐
Attr2Font	不裁才	残曹产	长畅	) 掣彻目	巨成承	.匙迟	尺翅斥	五出矗	处川串	大带
ground truth	不裁才	残曹产	长盼	掣彻目	巨成承	匙迟	尺翅斤	丑出蠢	处川串	大带
attributa									_	
attribute		<u></u>		<		<b>7</b> .1		F		
Attr2Font	发凹敖	奥扒ハ	、爸日	井郡智	<b>夏卑本</b>	角比	必辟臂	· 变下虑	<b>这一次</b> 演录	博勃
ground truth	<b>安凹</b> 敖	奥扒八	、爸日	拝帮智	5 早 一 一	角比	必辟臂 (),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	受下愿	· <b></b> 述	博勃
Attr2Font	电刁丁	鼎定东	兜斗	-段断朝	の向儿	二贰	发乏返	之方了	ミキ弗甫	i斧腐
ground truth	电刁丁	鼎定东	兜斗	-段断可	<b>贞而</b> 儿	<u></u> 二 、	友之返	、次万、	、 手 弗 甫	ī斧腐 ·
Attr2Font	不裁才	残曹产	长畅	掣彻日	2成承	匙迟	尺翅斥	五出聶	处川串	大带
ground truth	不裁才	·残曹产	长畅	寧彻日	2成承	影迟	尺翅斥	這出日	上处川串	大带

Fig. 5. Generating Chinese fonts from attributes.

font 1	A B	<b>C</b>	D	E	<b>F</b> (	<b>G</b> ]	H ]	[ <b>J</b>	K	L	Μ	Ν	0	P	Q	R	S	Т	U	V	W	Χ	Y	Ζ
$\lambda = 0.0$	A B	<b>C</b>	D	E	F	<b>G</b> ]	H ]	IJ	Κ	L	Μ	Ν	0	P	Q	R	S	Τ	U	V	W	Х	Y	Ζ
$\lambda = 0.1$	A B	<b>C</b>	D	E	F	<b>G</b> ]	<b>H</b> ]	IJ	Κ	L	Μ	Ν	0	P	Q	R	S	Τ	U	V	W	Х	Y	Ζ
$\lambda = 0.2$	ΑB	C	D	E	F	<b>G</b> ]	H I	IJ	Κ	L	Μ	Ν	0	P	Q	R	S	Τ	U	V	W	Χ	Y	Ζ
$\lambda = 0.3$	ΑΒ	C	D	E	F	G I	H I	IJ	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Τ	U	V	W	Х	Y	Ζ
$\lambda = 0.4$	ΑB	С	D	ΕÌ	F	G	HI	IJ	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Υ	Ζ
$\lambda = 0.5$	ΑB	C	D	ΕI	F	<b>G</b>	HI	IJ	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Y	Ζ
$\lambda = 0.6$	ΑB	С	D	E	F	<b>G</b>	HI	IJ	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Y	Ζ
$\lambda = 0.7$	A B	С	D	E	F	<b>G</b>	HI	IJ	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	X	Y	Ζ
$\lambda = 0.8$	A B	C	D	E	F	G I	HI	IJ	K	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Y	Ζ
$\lambda = 0.9$	A B	C	D	E	F	G I	HI	IJ	Κ	L	M	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Y	Ζ
$\lambda = 1.0$	A B	С	D	E	F	<b>G</b>	HI	IJ	Κ	L	M	Ν	0	Ρ	Q	R	S	Т	U	V	W	X	Y	Z
font 2	A B	C	D	E	F	GI	HI	J	K	L	Ň	N	0	Ρ	Q	R	S	T	U	V	W	X	Y	Z
$\lambda = 0.0$	A B	C	D	ΕI	F	G	HI	IJ	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	X	Y	Ζ
$\lambda = 0.1$	AB	С	D	ΕI	F	<b>G</b>	HI	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Y	Ζ
$\lambda = 0.2$	AB	C	D	ΕI	F	G	HI	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Y	Ζ
$\lambda = 0.3$	ΑB	C	D	Ε	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Y	Ζ
$\lambda = 0.4$	ΑB	С	D	ΕI	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Υ	Ζ
$\lambda = 0.5$	ΑB	С	D	E	F	G	HI	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Υ	Ζ
$\lambda = 0.6$	ΑB	С	D	E	F	G	HI	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Υ	Ζ
$\lambda = 0.7$	ΑB	С	D	E	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Υ	Ζ
$\lambda = 0.8$	ΑB	С	D	Ε	F	G	HI	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Υ	Ζ
$\lambda = 0.9$	ΑB	С	D	Ε	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	۷	W	Х	Υ	Ζ
$\lambda = 1.0$	ΑB	С	D	Ε	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	۷	W	Х	Y	Ζ
font 3	ΑΒ	С	D	Ε	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Τ	U	V	W	Х	γ	Ζ
$\lambda = 0.0$	ΑB	С	D	Ε	F	G	ΗI	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Х	Y	Ζ
$\lambda = 0.1$	ΑB	С	D	Ε	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Х	Y	Ζ
$\lambda = 0.2$	ΑB	С	D	Ε	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Х	Y	Ζ
$\lambda = 0.3$	ΑB	С	D	Ε	F	G	H I	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	۷	W	Х	Y	Ζ
$\lambda = 0.4$	AB	С	D	Ε	F	G	ΗÌ	J	Κ	L	Μ	Ν	0	Ρ	Q	R	S	Т	U	V	W	Χ	Y	Ζ
									12		NЛ	NI	$\mathbf{O}$	P	Ň	R	ς	т	U	V	۱۸/	Υ	V	Ζ
$\lambda = 0.5$	AB	С	D	Ε	F	GI	ΗI	IJ	K	L	141	IN			Y	••	-		-	v	V V	Λ		
$\lambda = 0.5$ $\lambda = 0.6$	A B A B	C C	D D	E E	F F	G   G	H   H	J	K	L	M	N	ŏ	P	Q	R	S	Ť	Ŭ	v	Ŵ	Ŷ	Ý	Z
$\lambda = 0.5$ $\lambda = 0.6$ $\lambda = 0.7$	A B A B A B	C C C	D D D	E E E	F F F	G   G   G	H   H   H	J   J	K K K	L	M	N N	000	P P P	QQ	R R	S S	Ť T	Ŭ U	V V	ŴW	X X X	Y Y	ZZ
$\lambda = 0.5$ $\lambda = 0.6$ $\lambda = 0.7$ $\lambda = 0.8$	A B A B A B A B		D D D D D	E E E	F F F	G   G   G   G	H   H   H   H	]   ]   ]	K K K K	L	M M M M	N N N	0000	P P P	VQQQ QQQ	R R R	S S S S S	Ť T T	U U U	V V V V	W W W	× X X X X	Y Y Y Y	ZZZ
$\lambda = 0.5$ $\lambda = 0.6$ $\lambda = 0.7$ $\lambda = 0.8$ $\lambda = 0.9$	A B A B A B A B A B			E E E E	F F F F	G   G   G   G	H   H   H   H	]   ]   ]	K K K K K K K K		M M M M M	N N N N N	00000	- P P P P	Q Q Q Q Q Q Q	R R R R R	S S S S S S S	Ť T T T		V V V V V	W W W W	^X X X X X	Y Y Y Y Y	ZZZZZ
$\lambda = 0.5$ $\lambda = 0.6$ $\lambda = 0.7$ $\lambda = 0.8$ $\lambda = 0.9$ $\lambda = 1.0$	A B A B A B A B A B A B			E E E E E	FFFFFF	G G G G G G G G G G G G G G G G G G G	H   H   H   H   H	[ ] [ ] [ ]	K K K K K K K K K K K K K		M M M M M M M		000000	- P P P P P	YQQQQQQ		5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Ť T T T T T		V V V V V V V V V	W W W W W W	^X X X X X X X	Y Y Y Y Y Y Y	ZZZZZZ

Fig. 6. Generating English glyph images of upper cases by interpolation between the attribute values of two different fonts. Three interpolation processes (Font 1 to Font2, Font 2 to Font 3, Font 3 to Font 4) are presented in succession.

font 1	a	b	C	d	e	f	g	h	ij	j k		m	n	0	р	q	r	S	t	u	V	W	X	У	Z
$\lambda = 0.0$	а	b	С	d	e	f	g	h	ij	j k	: ]	l m	n	0	p	q	r	S	t	u	V	W	Х	У	Ζ
$\lambda = 0.1$	a	b	С	d	е	f	g	h	ij	j k	: ]	l m	n	0	р	q	r	S	t	u	V	W	Х	У	Ζ
$\lambda = 0.2$	a	b	С	d	е	f	g	h	i	j k		[ <b>m</b>	n	0	р	q	r	S	t	u	V	W	Х	У	Ζ
$\lambda = 0.3$	a	b	С	d	е	f	g	h	ij	j k		<b>m</b>	n	0	р	q	r	S	t	u	V	W	X	У	Ζ
$\lambda = 0.4$	a	b	C	d	е	f	g	h	ij	j k		<b>m</b>	n	0	р	q	r	S	t	u	V	W	X	У	Ζ
$\lambda = 0.5$	a	b	C	d	е	f	g	h	ij	j k		<b>m</b>	n	0	р	q	r	S	t	u	V	W	X	У	Ζ
$\lambda = 0.6$	a	b	C	d	е	f	g	h	i	j k		<b>m</b>	n	0	р	q	r	S	t	u	V	W	X	У	Ζ
$\lambda = 0.7$	a	b	C	d	e	f	g	h	i	j k		<b>m</b>	n	0	р	q	r	S	t	u	V	W	X	У	Ζ
$\lambda = 0.8$	a	b	C	d	e	f	g	h	ij	j k		<b>m</b>	n	0	р	q	r	S	t	u	V	W	X	У	Z
$\lambda = 0.9$	a	b	C	d	e	f	g	h	ij	j k		m	n	0	р	q	r	S	t	u	V	W	X	У	Z
$\lambda = 1.0$	a	b	C	d	e	f	g	h	<b>i</b> ]	j k		m	n	0	р	q	r	S	t	u	V	W	X	У	Z
font 2	a	b	C	d	e	f	g	h	]	j k		m	n	0	P	P	ľ	5	t	u	V	W	X	Y	Z
$\lambda = 0.0$	a	b	C	d	e	f	g	h	ij	j k		m	n	0	Ρ	q	r	S	t	u	V	W	X	Y	Z
$\lambda = 0.1$	a	b	C	d	e	f	5	h	ij	j k		<b>m</b>	n	0	Р	q	r	S	t	u	V	W	X	Y	Z
$\lambda = 0.2$	a	b	C	d	e	f	g	h	ij	j k		m	n	0	Ρ	q	r	S	t	u	V	W	X	Y	Ζ
$\lambda = 0.3$	a	b	С	d	е	f	B	h	ij	j k		<b>m</b>	n	0	Ρ	q	r	S	t	u	V	W	X	Υ	Ζ
$\lambda = 0.4$	a	b	C	d	е	f	g	h	ij	j k		<b>m</b>	n	0	Ρ	q	r	S	t	u	V	W	X	У	Ζ
$\lambda = 0.5$	a	b	C	d	е	f	G	h	ij	j k		<b>m</b>	n	0	Ρ	q	r	S	t	u	V	W	X	У	Ζ
$\lambda = 0.6$	а	b	С	d	е	f	S	h	i	j k		m	n	0	Ρ	q	r	S	t	u	V	W	Χ	У	Ζ
$\lambda = 0.7$	а	b	С	d	е	f	6	h	ij	j k		m	n	0	Ρ	q	r	S	t	u	V	W	Χ	Υ	Ζ
$\lambda = 0.8$	a	b	С	d	е	f	S	h	ij	j k		m	n	0	Ρ	q	r	S	t	u	V	W	Χ	У	Ζ
$\lambda = 0.9$	а	b	С	d	е	f	g	h	i	įk		m	n	0	Ρ	q	r	S	t	u	V	w	Χ	У	Ζ
$\lambda = 1.0$	а	b	С	d	е	f	S	h	i	į k		m	n	0	Ρ	q	r	S	t	u	V	W	Х	У	Ζ
font 3	а	b	С	d	6	f	g	h	i .	įk		m	n	0	р	q	r	S	t	u	V	W	Х	у	Ζ
$\lambda = 0.0$	а	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	۷	W	Χ	У	Ζ
$\lambda = 0.1$	а	b	С	d	е	f	g	h	i j	įk		m	n	0	р	q	r	S	t	u	V	W	Χ	у	Ζ
$\lambda = 0.2$	а	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	Χ	у	Ζ
$\lambda = 0.3$	а	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	Χ	у	Ζ
$\lambda = 0.4$	а	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	Χ	У	Ζ
$\lambda = 0.5$	a	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	Χ	У	Ζ
$\lambda = 0.6$	a	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	Χ	У	Ζ
$\lambda = 0.7$	a	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	Χ	У	Ζ
$\lambda = 0.8$	a	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	Χ	У	Ζ
$\lambda = 0.9$	a	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	X	У	Ζ
$\lambda = 1.0$	a	b	С	d	е	f	g	h	i	įk		m	n	0	р	q	r	S	t	u	V	W	X	У	Ζ
font 4	a	b	C	d	e	f	g	h	i	i k		m	n	0	р	q	r	S	t	u	V	W	X	У	Ζ

Fig. 7. Generating English glyph images of lower cases by interpolation between the attribute values of two different fonts. Three interpolation processes (Font 1 to Font2, Font 2 to Font 3, Font 3 to Font 4) are presented in succession.

font 1	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.0$	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.1$	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.2$	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.3$	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.4$	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.5$	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.6$	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.7$	斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.8$	斗段断顿而儿ニ贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 0.9$	斗段断顿而儿ニ贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
$\lambda = 1.0$	斗段断顿而儿ニ贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚
font 2	斗段断顿而儿二蕊发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康
font 3	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.0$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.1$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.2$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.3$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.4$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.5$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.6$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.7$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.8$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 0.9$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
$\lambda = 1.0$	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢
font 4	鼎定东兜斗段断顿而儿二贰发乏返泛方飞丰弗甫斧腐覆甘政
font 5	垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.0$	垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.1$	垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.2$	垂囱匆存寸大带速耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.3$	垂囱匆存寸大带速耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.4$	垂囟匆存寸大带速耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.5$	垂囱匆存寸大带速耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.6$	垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.7$	垂囱匆存寸大帝逮耽丹卑郸岛低弟电刁丁鼎定东兜斗段断顿
$\lambda = 0.8$	垂图匆存寸大帝逮耽丹卑郸岛低弗电习丁鼎定东兜斗段断顿
$\lambda = 0.9$	垂图匆仔寸大帝速职丹里郸岛低矛电刀丁鼎定东兜斗段断顿
$\lambda = 1.0$	世国为仔丁大帝逐帜丹里即岛低矛电刀了船定东兜斗段断顿 在白白大中上世界时间的面积从了中口下的白大街的(1)(1)(1)
font 6	要国乡保习大师还职丹早即岛低弟中习了航定东兜斗投断领

Fig. 8. Generating Chinese glyph images by interpolation between the attribute values of two different fonts (Part 1). Three interpolation processes (Font 1 to Font2, Font 3 to Font 4, Font 5 to Font 6) are presented in succession.

	ᅑᄞᆉᄼᅘᅫᇧᄽᇰᄼᇽᇏ	6 6 十 不 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
font 7		國军中角比必辟筲受卜彪瓯濒隶博别。
$\lambda = 0.0$	爱叫敖奥扒八谷白拜帮君	岛卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.1$	爱门教金扒八谷白拜帮雪	夏水番比心辟壁变大彪斌渐重博勃
$\lambda = 0.2$	受口放关门(XCC)/1778 受门敖匊扒八谷白拜赵雪	雪中不用比心和高文下的动物不同物
$\lambda = 0.3$	受口放关门(YED)7市包 受凹封匊扒八谷白拜邦雪	自中不用比少种有文下他风飘不同初
$\lambda = 0.4$	受口放关的\\ 一一一一一一一一一一一一一一一一一一一一一一一一一一一一一一一一一一一	四十个用比少叶月又下肥瓜颜术丹初
$\lambda = 0.5$	多回放关的 化色口纤带管	會由太否比必时得又下必减颇不同初
$\lambda = 0.6$	20000000000000000000000000000000000000	9年今月1220年月又下尼风/秋末侍初 19日末否比次位辟亦士长进渐毛捕劫
$\lambda = 0.7$	友口放突が <u>い</u> 色口汁市包 名叫封南北 八 父 古 在 邦 司	多年今用儿少叶月又下尨风淡末侍初
$\lambda = 0.8$	友口放突尔尔巴口汗带管	9.年 <b>仲用儿少叶月又下</b> 尼风侧末侍孙 6.由十本 <b>レ</b> 次位辟亦十长 <del>计</del> 将手捕劫
$\lambda = 0.0$	友口放突外外色口杆带管	多年今用儿少叶月又下必风侧末侍孙。
$\lambda = 0.9$	友口放突扒八百日开帘包	回年今用儿少奸育文卜彪风测末侍劲。 同中十四儿心时辟亦十岁好游手捕劫。
font 8	友口放突扒八百口杆带包	9年今用儿少奸育文下彪瓜侧末侍孙 6亩十四山心 应辞本十岁 计游手博动
10111 0	发出放突扒八百日并带着	包午平用化少奸育变卜尼风测末得初
font 9	爱凹敖奥扒八爸白拜帮霉	宽卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.0$	爱凹敖奥扒八谷白拜帮雪	5.卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.1$	爱凹敖奥扒八爸白拜帮雪	原卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.2$	爱凹敖奥扒八爸白拜帮雪	原卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.3$	爱凹敖奥扒八爸白拜帮雪	雷卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.4$	爱凹敖奥扒八谷白拜帮霍	原卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.5$	爱凹敖奥扒八谷白拜帮君	雷卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.6$	爱凹敖奥扒八谷白拜帮霍	富卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.7$	爱门敖奥扒八谷白拜帮霍	富卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.8$	爱凹敖奥扒八爸白拜帮霍	富卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 0.9$	爱凹敖奥扒八爸白拜帮霍	富卑本甭比必辟臂变卞彪斌濒秉博勃
$\lambda = 1.0$	爱凹敖奥扒八谷白拜帮霍	富卑本甭比必辟臂变卞彪斌濒秉博勃
font 10	爱凹敖奥扒八爸白拜帮君	岛卑本甭比必辟臂变下彪斌濒秉博勃
6		
lont 11	年电7 J 躲走朱允牛校财	「切川儿」」「反之巡之がに半年用テ
$\lambda = 0.0$	<b>年电</b> 7 」 新定 朱 先 斗 校 田	「「「「」」」「「」」」「「」」」」「「」」」」「「」」」」「」」」」」「「」」」」
$\lambda = 0.1$	<b>年电</b> 7 」 新定年党斗校团	「町川」)「「「「「「「「「」」」」」である。
$\lambda = 0.2$	<b>・ 第电 つ 」</b> 部 定 先 党 斗 技 団	「町川」」「「「「「「「「「」」」」」」、「「「」」」、「「」」、「「」」、「」」、
$\lambda = 0.3$	- <b>毎日つ」</b> 船足ホパ斗技団 	「「「」」「「」」「「」」「」」「「」」「」」「」」「」」「」」「」」「」」「
$\lambda = 0.4$	<b>毎日フ」</b> 崩定 5 円 1 月 回 1 日 1 日 1 日 1 日 1 日 1 日 1 日 1 日 1 日 1	们则川儿—凤友之巡之力飞丰历用斧
$\lambda = 0.5$	<b>毎日フェ</b> 県ウェアント段団	町町川儿― 凤友乙巡江力 い キ 年 用 弁
$\lambda = 0.0$	<b>年电门</b> 新廷朱咒斗段四	町町川儿―凤反乙辺に力、千年用斧
$\lambda = 0.7$	<b>历电幻</b> 月 崩 足 朱 兜 斗 段 函	川坝川儿一凤々之返に力、千冊用介
$\lambda = 0.8$	<b>历电</b> 7 丁 鼎 定 朱 兜 斗 段 幽	町町川山―
$\lambda = 0.9$	<b> </b>	■111111111111111111111111111111111111
$\lambda = 1.0$	<b> 宋电</b> <i>1</i> <u>1</u> <u>第</u> <u>1</u>	TWIII儿—— 或及之返之力 《丰弗用斧
home 10		

Fig. 9. Generating Chinese glyph images by interpolation between the attribute values of two different fonts (Part 2). Three interpolation processes (Font 7 to Font 8, Font 9 to Font 10, Font 11 to Font 12) are presented in succession.

strong

source font v = 0.0 v = 0.1 v = 0.2 v = 0.3 v = 0.4 v = 0.5 v = 0.6 v = 0.7 v = 0.8 v = 0.9 v = 1.0	<b>a</b> a a a a a a a a a a a a a a a a a a	<b>d d d d d d</b> d d d d <b>d</b>	<b>C</b> C C C C C C C C C C C C C C C C C C	<b>d</b> d d d d d d d d d d d d d d d d d d	e e e e e e e e e e e e e e e e e e e	f f f f f f f f f f f f f f f f f f f	<b>9</b> 999 <b>9999999999</b>	<b>h</b> hhhhhhhhhhhh		<b>×××××××××××</b> ×		m m m m m m m m m m m m m	nnnn <b>nnnn</b> n	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	<b>0000000000000</b>	<b>0</b> 00000000000000000000000000000000000	r r r r r r r r r r r r	S S S S S S S S S S S S S S S S S S S	t	<b>u</b> u u u u u u u u u u u u u u u u u u	<pre></pre>	₩ ※	× × × × × × × × × × × × × × × × × × ×	<b>y</b> y y y y y y y y y y y y y y	Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z
source font v = 0.0 v = 0.1 v = 0.2 v = 0.3 v = 0.4 v = 0.5 v = 0.6 v = 0.7 v = 0.8 v = 0.9 v = 1.0	aaaaaaaaaaaaa	<b>bbbbb</b> bbbbbbb	CCCCCCCCCCCC	dddddddddd	<b>eeeeeeee</b> eeeeeeeeeeeeeeeeeeeeeeeeeeee	f f f f f f f f f f f f f f f f f f f	<b>ටා ටා ටා ටා ටා</b> හා හා හා හා හා හා හා	hhhhhhhhhhhhhh		se kkkkkkkkkkkkkkkkkkkkkkkkk	rif   	m m m m m m m m m m	nnnnnnnnnnnn		u u u u u u u u u u u u u u u u u u u	<b>qqqqqqqq</b>	r r r r r r r r r r r r	S	t	U U U U U U U U U U U U U U U U U U U	V V V V V V V V V V V V V V V V V V V	W W W W W W W W W W W	X	y y y y y y y y y y y y	Z Z Z Z Z Z Z Z Z Z Z Z
source font v = 0.0 v = 0.1 v = 0.2 v = 0.3 v = 0.4 v = 0.5 v = 0.6 v = 0.7 v = 0.8 v = 0.9 v = 1.0	a a a a a a a a a a a a a a a a a a a	りりりりりりりりりりり	C C C C C C C C C C C C C C	000000000000000000000000000000000000000	e e e e e e e e e e e e e e e e e e e	f f f f f f f f f f f f f f f f f f f	9999999999999	hhhhhhhhhhhhh		<sup>ita</sup> <b>KKKKKKKKKKKKK</b>	llic                   	m m m m m m m m m m	nnnnnnnnnn	000000000000000000000000000000000000000	00000000000000000000000000000000000000	99999999999999999999999999999999999999	r r r r r r r r r r r r r	S	<b>t t t t t t t t t t t t t t t t t t t </b>		<pre></pre>	* * * * * * * * * * * * * * * * * * *	× × × × × × × × × × × × × × × × × × ×	УУУУУУУУУУУУ	Z Z Z Z Z Z Z Z Z Z Z Z Z

Fig. 10. Editing English fonts by changing the value of a single attribute (Part 1).

cursive source font ABCDEFGH J K L M N O P Q R S T U V W X Y Z Ι ABCDE v = 0.0F GΗ KLMNOPQR S Т UVWXYZ S Ζ ABCDE MNOPQR F GΗ J Κ L Т UVW XΥ v = 0.1F S Ζ E MNOPQR ABCD G Η J Κ Т UV Х Y v = 0.2W S E M N O P QR Ζ ABCD F G J К Т U VWX v = 0.3Н Y S AΒ СD E F G J К Μ NOPQ R Т U Х Ζ v = 0.4Н Y S Ζ E J Κ MNOPO R AΒ СD F G Н Т U W X v = 0.5V Y S ΑB С D E J Ν ΟΡ QR Τ 7 F G Н Κ L Μ U Х Y v = 0.6AΒ CD E F G Η ] K L M N O P QR S Т U Ζ WX Y V v = 0.7E 1 К LMNOPQR S Ζ AΒ CD F G Н l Т U VWXY v = 0.8LMNOPQR ABCD E F H JK S ΤΨΨ₩ΧΥΖ G l v = 0.9E F H l JKLMNOPQR S Z AΒ C  $\mathcal{D}$ G  $\mathcal{T}$ U V W X Yv = 1.0display KLMNOPQRS ABCDE GΗΙ J Ζ source font UVWXY Ζ ABC D E F KLMNOPQR S G Т UVWXY v = 0.0Н S Z E MNOPQR U ABCD F G J Κ Т Х v = 0.1н W Y S Ζ ABCD E F J Κ M N O P QR U v = 0.2G L Т V W Y S Ζ E OPQRABCD F J Т U v = 0.3G Н Κ L ΜN Υ 0 P O R S Ζ E F v = 0.4ABCD G Κ ΜN Т U Y н MNOPO S E J R 7 v = 0.5ABCD F G н Κ Т U Υ NOPQ R S Ζ v = 0.6ABCD F G J Μ Т U S Ζ MNOPO R v = 0.7 ABCD F F G Н J ΚI Т UV WX Y MNOPQR S 7 ABCD E G Κ L Т IJ XY v = 0.8н W JKLMNOPQRS UVWXYZv = 0.9ABCDE F GH Ι Т JKLMNOPQRS ABCD Ε F GΗ Т UVWXY 7 v = 1.0wide source font ABC MNOPQR S 7 G Y D F Κ U Ζ D Ε F 0 P 0 S v = 0.0В G Η I K L Μ Ν R Т U V Х Y Α C W S Ζ E Ρ 0 R v = 0.1Α B C D G Н K Μ Ν 0 Т U V S Ζ E F 0 Ρ 0 R v = 0.2А B C D G Н K М Ν Т U V Y W Ε R S Ζ Μ Ρ 0 v = 0.3Α B D G Ν 0 Т L Н К U V W S Ζ D E Ρ 0 R Т v = 0.4В K Ν 0 U Α L L Н М V W Y S Ζ Ε 0 В D F Ρ R Т v = 0.5Α C G К М Ν 0 н S E O P OR Ζ v = 0.6Α C D G Ν Т U В М Y S 7 J MNOPQ R v = 0.7C E F G Κ U ΑВ D н Х Υ QR S Ζ E ΟΡ Α В С D F G Ν Т v = 0.8н Μ Y MNOPOR S Ζ v = 0.9ABC D Ε F G J ΚL Т U WX Y Н V ΜΝΟΡΟ Ζ Ε F R S U v = 1.0ABCD G Н ΚL Т V WXY

Fig. 11. Editing English fonts by changing the value of a single attribute (Part 2).

charming

敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟 source font 敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟 v = 0.0v=0.1 敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟 敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂 v = 0.2敖奥扒八爸尺翅博勃不裁才残曹 产长畅掣彻臣成承匙必辟臂 v = 0.3v=0.4 敖奥扒八谷尺翅博勃不裁才残曹 产长畅掣彻臣成承匙必辟 产长畅掣彻臣成承匙必辟臂 敖奥扒八爸尺翅博勃不裁才残曹 v = 0.5敖奥扒八爸尺翅博勃不裁才残曹 产长畅掣彻臣成承匙必辟臂 v = 0.6敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂 v = 0.7v=0.8 敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂 v=0.9 敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂 敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂 v = 1.0

display

垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 source font 垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 0.0v=0.1 垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 0.2垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 0.3垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 0.4垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 0.5垂囱匆存寸大带逮耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 0.6垂囱匆存寸大带速耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v=0.7垂囱匆存寸大带速耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 0.8垂囱匆存寸大带速耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 0.9垂囱匆存寸大带速耽丹单郸岛低弟电刁丁鼎定东兜斗段断顿 v = 1.0

斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆 甘敢哥革更 source font 斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐 覆 甘敢哥革更 庚 v = 0.0厅丑出矗而儿二贰发乏返泛方 飞丰弗甫斧腐覆 革更 v = 0.1甘敢哥 康 v=0.2 斥丑出矗而儿二贰发乏返泛方 飞丰弗甫斧腐 覆 甘敢哥革更 庚 甘敢哥革更 斥丑出矗而儿ニ贰发乏返泛方 飞丰弗甫斧腐覆 v = 0.3ᢧ= 0.4 斥丑出矗而儿二贰发乏返泛方 飞丰弗甫斧腐 甘敢哥革更 覆 v=0.5 斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚 斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚 v = 0.6v=0.7 斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆 甘敢哥革更庚 v=0.8 斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚 v=0.9 斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚 v=1.0 斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更

dramatic

Fig. 12. Editing Chinese fonts by changing the value of a single attribute (Part 1).

### formal

source font **敖與扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟**臂 v=0.0 **敖與扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟**臂 v=0.1 **敖與扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟**臂 v=0.2 **敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟**臂 v=0.3 **敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟**臂 v=0.4 **敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟**臂 v=0.5 **敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟**臂 v=0.6 **敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必**辟臂 v=0.7 <u></u>敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂 v=0.8 <u></u>敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂 v=0.9 <u></u>敖奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂 v=0.9 <u></u>教奥扒八爸尺翅博勃不裁才残曹产长畅掣彻臣成承匙必辟臂

gentle

source fort 垂 **a** 匆存 **j** 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.0 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.1 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.3 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.4 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.5 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.6 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.7 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.8 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.9 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿 v=0.0 垂 囱 匆存 寸 大带速 耽 丹 单 郸 岛 低 弟 电 刁 丁 鼎 定 东 兜 斗 段 断 顿

thin

source fort **斥丑幽矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康** v=0.0 **斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康** v=0.1 **斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康** v=0.2 **斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康** v=0.3 **斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康** v=0.4 **斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康** v=0.5 **斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康** v=0.6 **斥丑出矗而儿二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康** v=0.7 **斥丑出矗而儿二贰发乏**返泛方飞丰弗甫斧腐覆甘敢哥革更康 v=0.8 **斥丑出矗而儿**二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康 v=0.9 **斥丑出矗而儿**二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更康 v=0.9 **斥丑出矗而儿**二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚 v=0.0 **斥丑出矗而儿**二贰发乏返泛方飞丰弗甫斧腐覆甘敢哥革更庚

Fig. 13. Editing Chinese fonts by changing the value of a single attribute (Part 2).

	angular	boring	clumsy del	licate formal	gentle italic	monospace serif	soft wide
attribute							
AttGAN	o b A B	0 0 0 C D E	E961 E0H1	ijklπ IJKLN		Q r s l u Q R S I U	vwxyz VWXYZ
StarGAN	a b	cde	f9hi	ijkLm	n o p	qrs <u>k</u> u	vwxyz
	A B	CDE	FGH1	IJKLM	INOP	ORSTU	vWXyz
RelGAN	аb AXB	cde CDE	F	l 🖞 k l m l l K L M	n o P N O P	A T S 1 U O R S T U	VWXYZ VWXYZ
STGAN	ab	cde	fghi	ijklm	n o p	qrstu	vwxyz
	AB	CDE	FGHI	IJKLM	I N O P	ORSTU	VWXyZ
Attr2Font	а b	c d e	fghi	ijklm	nnop	qrstu	vwxyz
	А B	C D E	FGHl	IJKLM	INOP	QRSTU	VWXYZ
ground truth	a b	cde	f g h i	Ĺjklm	nop	qrstu	VWXYZ
	A B	CDE	F G H I	ĹJKLM	INOP	QRSTU	VWXYZ
attribute							
AttGAN	a b A B	cde CDE	19hi FGHI	Î Î K Î M Î J K L N	IN O P	Q T S I U Q R S T U	VWXYZ VWXYZ
StarGAN	a b A B	cde CDE	f 9 h i F G H 1	ijkin Tikin	INOP	g r s t u ù r s t u	vwx¥z vwxYz
RelGAN	а	cde CDE	f 9 h i F G H i	<b>] k</b>   N   <b>  K L</b> N	INOP	9 r s t u D R S T U	VWXYZ VWXYZ
STGAN	ad Ab	CDE	toki Fghi	FJKEN	NOP	9rstu Drstu	VWXYZ
Attr2Font	a b	cde	f9hi	i j k l m	n o p	q <b>r</b> stu	VWXYZ
	A B	CDE	FGHI	J K L M	I N O P	QRSTU	VWXYZ
ground truth	а Ь А В	c d e C D E	fghi FGHI	ijklm IJKLN	INOP	qrstu QRSTU	VWXYZ VWXYZ
attribute							
AttGAN	о b	cde	f 9 h 1	I I K I N	ID O P	qrstu	vwxyz
	А B	CDE	F G H 1	I J K L N	IN O P	QRSTU	VWXYZ
StarGAN	а <u>b</u>	cde	fghi	ijkIn	nnop	qrstu	vwxyz
	А B	CDE	FGHI	IJKLM	INOP(	LRSTU	VWXYZ
RelGAN	о ђ	cde	f9hi	i j k T n	nnop	qrsfu	vwxyz
	ЖВ	CDE	FGHI	I J K L N	INOP	QRSTU	VWXYZ
STGAN	а ђ	cde	fghi	ijklm	nnop	qrstu	vwxyz
	А В	CDE	FGHI	IJKLM	INOP(	LRSTU	VWXYZ
Attr2Font	аb	cde	f g h i	ijklm	nnop	qrstu	vwxyz
	АВ	CDE	F G H l	IJKLM	INOP	QRSTU	VWXYZ
ground truth	а b	cde	f g h i	ijklm	nnop	qrstu	vwxyz
	А B	CDE	F G H l	IJKLN	INOP	QRSTU	VWXYZ

Fig. 14. Comparison with existing methods of attribute-controllable image synthesis (Part 1).

	angul	ar		bor	ing		clum	ısy	delic	ate	t	form	al	gent	le	itali	c m	onos †	pace	ser	if	sc	oft		1	vide
attribute																Ľ.										,
AHC AN	a	b	С	d	e	ſ	g	h	i	j	k	1	m	n	0	Þ	q	r	S	L	U	0	m	X	Y	Z
AllGAN	A	B	C	D	E	F	G	H	I	T	Н	L	M	N	0	P	Q	R	S	T	U	V	W	Х	Y	Z
04 O ANI	a	b	С	d	e	f	g	h	i	ĵ	k	1	m	n	0	p	q	r	s	t	u	v	w	x	у	z
StarGAN	A	B	С	D	E	F	Ģ	Η	1	J	K	L	М	N	Q	P	Q	R	Ş	Ţ	Ų	V	W	Х	Y	Ζ
	a	b	С	d	е	ſ	R	h	i	i	k	I	m	n	0	Þ	ą	r	S	Ŀ	u	D	w	X	y	Z
RelGAN	A	B	С	D	E	F	G	H	Ī	Ť	K	L	M	N	0	P	9	R	S	T	U	V	W	X	γ	Z
	а	b	С	d	e	f	g	h	i	ĵ	k	I	m	n	0	p	q	r	S	t	u	v	w	x	Y	z
STGAN	A	B	С	D	E	F	G	Η	I	Ĵ	K	Ĺ	Μ	N	0	P	Q	R	S	Т	U	V	W	X	Y	Ζ
	a	b	С	d	e	f	g	h	i	i	k	1	m	n	0	р	q	r	S	t	u	v	w	x	y	Z
Attr2Font	Α	B	С	D	Ε	F	G	H	Ι	Ĵ	K	Ĺ	Μ	Ν	0	P	Q	R	S	Т	U	v	w	Х	Y	Ζ
	a	h	С	d	е	f	g	h	i	i	k	1	m	n	0	p	q	r	S	t	u	ν	w	x	y	Z
ground truth	Α	B	С	D	Е	F	Ğ	Ĥ	Î	Ĵ	ĸ	Ĺ	Μ	N	0	P	Ó	R	S	T	U	v	W	x	Ŷ	Z
								_		-					-		~				_					
attribute		÷.		æ		- 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10	2	42			÷.	4.				20	č?			41	21/	202		77	422	
AttGAN	E.	D D	10	0. 71	r n	1	N.	h	4	1	K	1	III.	15	р сл	¥ n	N.	T T	N.	J.	10 17	N 17	YV VXT	X V2	X V	K.
	A	b b	¢.	μ	10	1	sa m	n D	¥.	1	ĸ	1.	IVE	N	U n	ľ	N.	ĸ	\$	1	Ų T	N	¥ν 	x	X N	K.
StarGAN	Q A	15 D	C	đ	e	I	U O	K	1	Ļ	R	I	113 3.4	1)	0	P		<u>F</u>	S.	L	U.	V	W	X	Y	K.
	. #	B	C	D	Ľ	F	6	H	1	4	K	L	M	N	U	P	U	K	S	T	U	V	W	A	Y	Z
RelGAN	- IN M	R	F	K.	F	I	5	К	Ţ	Ţ	K	1	m	R	F	F	1	F	5	L	N	Y	W	N	Y	X
	A.	R	C	IJ	E	F	6	H	1	1	h	Ľ	M	N	U	ľ	Q	K	3	T	t/	Y	W	A	Y	A
STGAN	a	ß	C	đ	G	ľ	9	k	Ĩ	Į	ĸ	Į	m		0	P	9	ľ	S	ľ	U	V	W	N	Y	Z
	Æ	В	C	D	E	F	G	H	1	J	K	E	$M_{\rm c}$	N	0	P	Ų	K	S	T	U	V	W	A	Y	Z
Attr2Font	a	b	C	d	e	f	g	h	i	J	k	-	m	n	0	P	<b>q</b>	r	S	t	u	V	W	X	y	Z
	A	B	С	D	E	F	G	Η	I	J	K	L	M	N	0	Р	Q	R	S	Т	U	V	W	X	Y	Z
ground truth	a	b	С	d	e	f	g	h	i	j	k	l	m	n	0	p	q	r	S	t	U	V	W	x	Y	Z
0	A	B	С	D	ε	F	G	H	J	J	K	L	m	n	0	Р	Q	R	S	7	U	V	W	X	Y	Z
attribute																										
AttGAN	8	0	Q	U n	0	T a	0	H	ALC:	11	H	派行	1 II II	0 H	0	A	n	E n	8	道行	0	U II	10	H	U	Ba
	1	h	N C	и Н	Li D	f	a	h	- 48,	- <u>u</u> i	4	344 	m	n	а П	n	U N	r	u c	~%. ∔	ч П	ъл V	11 W	N V	V	16j 7
StarGAN	Λ	D	ĉ	u N	E	È	Б С	ü	1	1	K	ł	м	N	n	P D	ň	D	S C	Ť	u II	Ň	Ŵ	Ŷ	v	7
	A D	D	C n	U H	D	1	n	11	1	1	17	1 17	1¥1 285%	n	U n	n	v n	n fi	0	ft.	11	V A R	N N Realist		1	L
RelGAN	0	D	u n	UD	D	I D	D	L	IT	1	N Lä	L	U	U U	U n	E n	n	D D	D	1 T	U II	U	U	П Ц	U	0
	1	D	0	U	0	C'	U n	11	1	u i	Ti I.	L	[] m	n	U	n	U	K	D	1	u	U	FI W	П У	U V	5
STGAN	d	D	U C	D	С Г	ŗ	Š	n		ļ	K	ł	M	II M	0	h	Y A	I	5	Ţ	u II	V V	W	X	y V	27
	A	D	ե Շ	U	C	۲ ۲	U	П	1	ì	Ň	L	IN .	N	U	r	V a	ĸ	3		U	V	W	Ň	Ĭ	2
Attr2Font	đ	D	C	D	e	Ĩ	y	n	ļ	ļ	K	1	III M	П	0	4	Y A	ſ	S	Ţ	u	V	W	X	У У	27
	A	R	L	IJ	E	F	5	Η		J	ĸ	Ļ	M	N	U	2	Ų	K	2		U	V	W	X	Y	2
ground truth	a A	b B	с С	d D	e E	f F	g G	h H	ĺ I	] J	k K	l L	m M	n N	0 0	р Р	q Q	г R	s S	t T	u U	v V	W W	X X	У Ү	z Z

Fig. 15. Comparison with existing methods of attribute-controllable image synthesis (Part 2).

## The Supplemental Material for "Attribute2Font: Creating Fonts You Want From Attributes" • 15

	a	rtisti	с		ca	npita †	ls		deli	cate	:	form †	nal	gent ↑	le	ital	ic		pla	iyful ↑			stron	ıg	1	vide ↑
attribute O'Donovan et al.	a A	b B	с С	d D	e E	f F	g G	h H	i I	j J	k K	l L	m M	n N	0 0	р Р	q Q	r R	s S	t T	u U	v V	W W	х Х	у Ү	z Z
Chen et al.	a A	b B	с (	d D	e E	f F	g G	h H	i I	j J	k K	l	m M	n N	0 0	р Р	q Q	r R	s S	t T	u U	v V	w W	x X	y Y	z Z
Attr2Font	a A A	b B b	C C	d D	e E	f F ←	Υ G σ	h H h		ر ا	k K		M M	n N	000000000000000000000000000000000000000	р Р р	Q	r R	S S	t T +	U	V	W	X X ×	У Ү У	ZZ
ground truth	a A	D B	C	a D	E	F	e G	n H	I	J J	k K	L	М	N	0	P	Q	R	S	T	U	V	W	X	у Ү	Z
attribute	a	b	C	d	e	f	g	h	i	i	k	1	m	n	0	р	q	r	S	t	u	V	W	X	y	Z
O'Donovan et al.	A	B	С	D	E	F	G	H	Ī	Ĵ	K	Ĺ	Μ	Ν	0	P	Q	R	S	Ť	U	V	W	Х	Ý	Ζ
Chen et al.	a A	b B	c C	d D	e E	f F	g G	h H	i 	j J	k K	 L	m M	n N	0 0	р Р	q Q	r R	s S	t T	u U	v V	w W	x X	y Y	z Z
Attr2Font	a A	b B	c C	d D	e E	f F	g G	h H	i 	j j	k K		m M	n N	0 0	p P N	q Q Q	r R	s S	t T	u U	V V	W W	X X	y Y	z Z
ground truth	a A	b B	c C	d D	e E	† F	y G	h H	ן 	) J	K	l L	m M	n N	0	P P	Ч Q	r R	s S	t T	u U	V V	W	X X	у Ү	z Z
attribute		h		4	•	•	ď	L	-	:	l.	T	m	n		n	n	r		+				v	v	7
O'Donovan et al.	a A	D B B		a D D	Ē	F	G	H	i	j	K	Ĺ	M	N		P	Ч Q	R	S S	Ī	Ü	V	W	X	Y	Z
Chen et al.	A	B	C	D	E	F	G	H		J	ĸ	Ľ	M	N	0	P	Q	R	5 5	Ť	U	V	W	X	Y	Z
Attr2Font	a A	b B	C C	d D	e E	f F	g G	h H	i	j J	k K	l L	m M	n N	0 0	P P	q Q	r R	S S	t T	u U	V V	w W	X X	Y Y	Z Z
ground truth	a A	b B	C C	d D	e E	f F	g G	h H		J	k K	I L	m M	n N	0	P P	9 Q	r R	s S	t T	u U	V V	w W	X X	Y Y	z Z

Fig. 16. Comparison of our model and two existing font retrieval methods.

## 16 • Yizhi Wang, Yue Gao, and Zhouhui Lian

	input	Arched Eyebrows	Bags Under Eyes	Bald	Bangs	Black Hair	Blond Hair	Brown Hair	Bushy Eyebrows	Double Chin	Eyeglasses	Gray Hair (	High Cheekbones	Narrow Eyes	Pale Skin	Sideburns	Smiling	Wavy Hair	Wearing Hat
StarGAN	6	0	0	9	0	0	6	6		0	9	0	1	9	9	0		0	0
StarGAN+AAM	6			0		0	0	0		0		0	0	0	0			0	Ø
StarGAN						-				0					0				<b>(</b> )
StarGAN+AAM							(B)					3							
StarGAN	6	6		6	0	6	0	6	6	0	6		6	6	6	6	G	0	G
StarGAN+AAM	6		Q	Q	0	Q	0	0	0	0	0	0	Q	Q	Q	Q	Q	0	0
StarGAN				-	(		0	6	0	6		3	6		0		-	6	8
StarGAN+AAM					(			6		6	1	e			e	e	-	6	
StarGAN	6		B	Ð	Ø	D	0	Ð	Ø	0	0	Ð	1	Ø	Ð		9	0	1
StarGAN+AAM	6			Ð	Ø	Ø	Ø			0		Ð	Ð	Ð	Ø	Ø	P	0	Ø
StarGAN	FOCIN	10	E	E			E		E	E	6	A CAL	E	E	C.		E	G	E
StarGAN+AAM	TOEIL	.6	C.	G	S		E.			En		E	and the second	G	G	D	A.	- Ca	E
StarGAN			D.	D.	D.	6	Ø.			D.	9	G.		Đ.		D.	D.	Ø	
StarGAN+AAM				Q		Q.	D.	0		0	Q	Ø	9	Q	0	Q	0	0	
StarGAN	0		8	0	0	8	3	8	8	0	0	B	0	0	6	8	0	0	0
StarGAN+AAM	0		0			0	9	0	0	0	9	B	0	0	0	9	9	0	
StarGAN	C			0		6	6	Ø				0	6		0		0	E	1
StarGAN+AAM	C		0		6	0	6	6	6	6	6	6	6	6	0	6	E	100	6

Fig. 17. Comparison of StarGAN+AAM and StarGAN. The input images are selected from a publicly-available database [Liu et al. 2015] whose training set is adopted to train the models. The red rectangles emphasize some cases where StarGAN+AAM significantly differs with StarGAN.

source font	a	b	c	d	e	f	g	h	i	j	k		m	n	0	р	q	r	s	t	u	v	w	x	y	z
	A	B	C	D	E	F	G	H		J	K	L	M	N	0	Р	Q	R	S	T	U	V	W	X	Y	Z
random font	a A	b B	C C	d D	e E	f F	g G	h H	:   	j J	k K		m M	n N	0 ()	р Р	Q Q	r R	s S	t T	u U	$\lor$	W W/	× X	У Ү	z Z
random font	a	b	c	d	e	f	g	h	i	j	k	l	m	n	0	p	q	r	s	t	u	v	w	X	y	z
	A	B	C	D	E	F	G	H	l	J	K	L	M	N	0	P	Q	R	S	T	V	V	W	X	Y	Z
random font	a	b	с	d	e	f	9	h	i	j	k	l	m	n	0	р	q	r	s	t	u	v	w	x	Y	z
	A	B	С	D	E	F	G	H	[	J	K	L	M	N	0	Р	Q	R	S	T	U	V	W	X	Y	Z
random font	a	b	c	d	e	f	g	h	i	j	k	1	m	n	о	р	q	r	s	t	u	v	w	x	y	z
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	О	Р	Q	R	S	T	U	V	W	X	Y	Z
random font	a	b	c	d	e	f	g	h	i	j	k	1	m	n	o	p	q	r	s	t	u	v	w	x	y	z
	A	B	C	D	E	F	G	H	l	J	K	L	M	N	0	P	Q	R	S	T	V	V	W	X	γ	Z
random font	a	b	с	d	e	f	g	h	i	j	k	l	m	n	о	p	q	r	s	t	u	v	W	x	y	z
	A	B	С	D	E	F	G	H	[	J	K	L	M	N	О	P	Q	R	S	T	U	V	W	X	Y	Z
random font	a A	b B	с С	d D	e E	f F	g G	h Н	i [	j J	k K	l L	m M	n N	о О	р Р	9 Q	r R	s S	$t \ {\cal T}$	u U	v V	w W	x X	y Y	z Z
random font	a	b	C	d	e	f	g	h	i	j	k		m	п	0	р	<b>q</b>	r	s	t	u	v	w	x	Ч	z
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	0	Р	Q	R	S	T	U	V	W	X	Ү	Z
random font	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
	A	B	C	D	E	F	G	H		J	K	L	M	N	0	P	Q	R	S	T	U	V	W	X	Y	Z
random font	a	b	c	d	e	f	g	h	i	j	k	1	m	n	o	р	q	r	s	t	u	v	w	x	y	z
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	D	Р	Q	R	S	T	U	V	W	X	Y	Z

Fig. 18. The glyph images of a whole char-set generated by our method from random attribute values.

# Font 1

Lorem ipsum dolor sit amet consectetur adipisicing elit sed do eiusm od tempor incididunt ut labore et dolore magna aliqua Ut enim ad mini m veniam quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat Duis aute irure dolor in reprehenderit in volup tate velit esse cillum dolore eu fugiat nulla pariatur Excepteur sint occaecat cupidatat non proident sunt in culpa qui officia deserunt m ollit anim id est laborum

# Font 2

Lorem ipsum dolor sit amet consectetur adipisicing elit sed do eiusm od tempor incididunt ut labore et dolore magna aliqua Ut enim ad mini m veniam quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat Duis aute irure dolor in reprehenderit in volup tate velit esse cillum dolore eu fugiat nulla pariatur Excepteur sint occaecat cupidatat non proident sunt in culpa qui officia deserunt m ollit anim id est laborum

# Font 3

Lorem ipsum dolor sit amet consectetur adipisicing elit sed do eiusm od tempor incididunt ut labore et dolore magna aliqua Ut enim ad mini m veniam quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat Duis aute irure dolor in reprehenderit in volup tate velit esse cillum dolore eu fugiat nulla pariatur Excepteur sint occaecat cupidatat non proident sunt in culpa qui officia deserunt m ollit anim id est laborum

Fig. 19. Some continuous texts rendered by our model's generated fonts. We manually adjust the offsets of some characters. Font 1 is generated from a random set of attribute values. Font 2 and Font 3 are generated from two sets of attribute values in the validation dataset.