

## Emoji again

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Because at the ConT<sub>E</sub>Xt 2016 meeting color fonts<sup>1</sup> were on the agenda, some time was spent on emoji (these colorful small picture glyphs). When possible I bring kids to the BachoT<sub>E</sub>X conference so for the 2017 BachoTUG I decided to do something with emoji that, after all, are mostly used by those younger than I am. So, I had to take a look at the current state. Here are some observations.

The UNICODE standard defines a whole lot of emoji and if mankind manages to survive for a while one can assume that a lot more will be added. After all, icons as well as variants keep evolving. There are several ways to organize these symbols in groups but I will not give grouping a try. Just visit [emojipedia.org](http://emojipedia.org) and you get served well. For this story I only mention that:

- There are quite some shapes and nearly all of them are in color. The yellow ones, smilies and such, are quite prominently present but there are many more.
- A special subset is filled by persons: man, woman, girl, boy and recently a baby.
- The grown ups can be combined in loving couples (either or not kissing) and then can form families, but only upto 2 young kids or gender neutral babies.
- All persons can be flagged with one of five skin tones so that not all persons (or heads) look bright yellow.
- Interesting is that girls and boys are still fond of magenta (pinkish) and cyan (blueish) cloths and ornaments. Also hair-cuts are rather specific to the gender.

For rendering color emojis we have a few color related OPENTYPE font properties available: bitmaps, SVG and stacked glyphs. Now, if you think of the

combinations that can be made with skin tones, you realize that fonts can become pretty large if each combination results in a glyph. In the first half of 2017 MICROSOFT released an update for its emoji font and the company took the challenge to provide not only mixed skin tone couples, but also supported skin tones for the kids, including a baby. This recent addition already adds over 25.000 additional glyphs<sup>2</sup> so imagine what will happen in the future. But, instead of making a picture for each variant, a different solution has been chosen. For coloring this `seguiemj` font uses the (very flexible) stacking technology: a color shape is an overlay of colored symbols. The colors are organized in pallets and it's no big deal to add additional pallets if needed. Instead of adding pre-composed shapes (as is needed with bitmaps and SVG) snippets are used to build alternative glyphs and these can be combined into new shapes by substitution and positioning (for that kerns, mark anchoring and distance compensation is used).

So, a family can be constructed of composed shapes (man, woman, etc) that each are composed of snippets (skull, hair, mouth, eyes). So, effectively a family of four is a bunch of maybe 25 small glyphs overlaid and colored. In figure 1 we see how a shape is constructed out of separate glyphs.

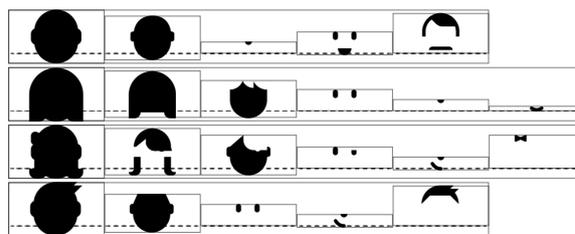


Figure 1: Emoji snippets.

<sup>1</sup> For that occasion the cowfont, a practical joke concerning Dutch 'koeieletters', were turned into a color font and presented at the meeting.

<sup>2</sup> That is the amount I counted when I added all combinations runtime but the emojipedia mentions twice that amount. Currently in ConT<sub>E</sub>Xt we resolve such combinations when requested.

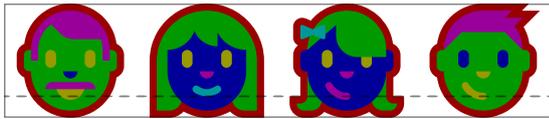


Figure 2: Emoji snippets overlaid.

Figure 2 shows how they can be overlaid with colors [we use a dedicated color set].

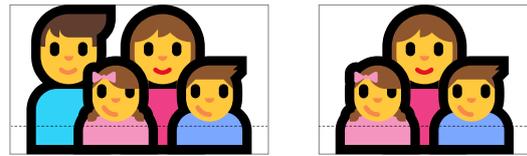
When a font supports it, a sequence of emoji can be turned into a more compact representation. In figure 3 we see how skin tones are applied in such combinations.

When we have to choose a font we need to take the following criteria into account:

- What is the quality of the shapes? For sure, outlines are best if you want to scale too.
- How efficient is a shape constructed. In that respect a bitmap or SVG image is just one entity.
- How well can (semi) arbitrary combinations of emoji be provided. Here the glyph approach wins.
- Are all skin colors for all human related shapes supported? Actually it opens the possibility for racist fonts.
- Are all reasonable combinations of persons supported? It looks like (depending on time and version) kissing men or women can be missing, maybe because of social political reasons.
- Are black and white shapes provided alongside color shapes.

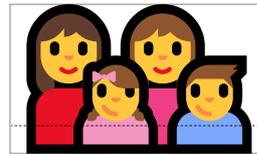
Maybe an SVG or bitmap image can have a lot of detail compared to a stacked glyph but, when we're just using pictographic representations, the later is the best choice.

When I was playing a bit with the skin tone variants and other combinations that should result in some composed shape, I used the UNICODE test files but I got the impression that there are some errors in the test suite, for instance with respect to modifiers. Maybe the fonts are just doing the wrong thing or maybe some implement these sequences a bit inconsistently. This will probably improve over time but the question is if we should intercept issues. I'm not in favour of this because it adds

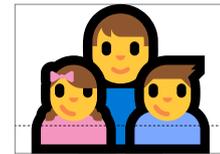


family man  
woman girl boy

family woman  
girl boy



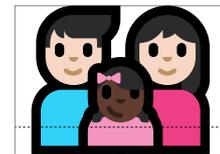
family woman  
woman girl boy



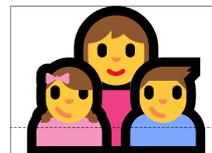
family man  
girl boy



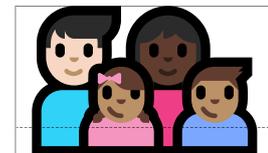
family man dark skin  
tone woman girl baby



family man light  
skin tone woman  
light skin tone girl  
dark skin tone



family woman  
girl boy



family man light  
skin tone woman  
dark skin tone girl  
medium skin tone boy  
medium skin tone

Figure 3: Emoji families and such with skin tones.

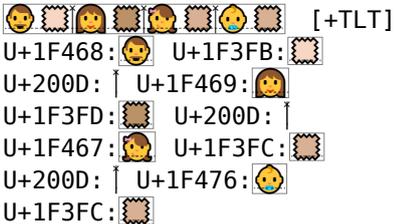
more and more fuzzy code that not only wastes cycles [energy] but is also a conceptual horror. So, when testing, imperfection has to be accepted for now. This is no big deal as until now no one ever asked for emoji support in ConTeXt.

When no combined shape is provided, the original sequence shows up. A side effect can be that zero-width-joiners and modifiers become visible. This depends on the fonts. Users probably don't care that much about it. Now how do we suppose that

users enter these emoji (sequences) in a document source? One can imagine a pop up in the editor but TeXies are often using commands for special cases. We already showed some combined shapes. The reader might appreciate the outcome but getting there from the input takes a bit of work. For instance a two person man light skin tone woman medium skin tone girl medium-light skin tone baby medium-light skin tone involves this:

**font** 67: seguiemj.ttf @ 10.0pt

**features** [basic: ccmp=yes, dist=yes, mark=yes, mkmk=yes, script=dflt, tlig=yes, trep=yes] [extra: analyze=yes, autolanguage=position, autoscript=position, checkmarks=yes, colr=yes, curs=yes, devanagari=yes, dummies=yes, extensions=yes, extrafeatures=yes, extraprivates=yes, kern=yes, liga=yes, mathkerns=yes, mathrules=yes, mode=node, spacekern=yes, visualspace=yes]

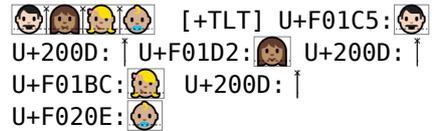
**step 1**  [+TLT]  
 U+1F468:  U+1F3FB:   
 U+200D: ↑ U+1F469:   
 U+1F3FD:  U+200D: ↑  
 U+1F467:  U+1F3FC:   
 U+200D: ↑ U+1F476:   
 U+1F3FC: 

feature 'ccmp', type 'gsub\_ligature', lookup 's\_s\_0', replacing U+1F468 upto U+1F3FB by ligature U+F01C5 case 2

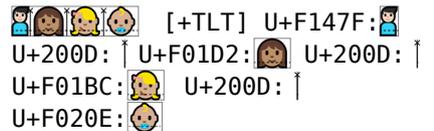
feature 'ccmp', type 'gsub\_ligature', lookup 's\_s\_0', replacing U+1F469 upto U+1F3FD by ligature U+F01D2 case 2

feature 'ccmp', type 'gsub\_ligature', lookup 's\_s\_0', replacing U+1F467 upto U+1F3FC by ligature U+F01BC case 2

feature 'ccmp', type 'gsub\_ligature', lookup 's\_s\_0', replacing U+1F476 upto U+1F3FC by ligature U+F020E case 2

**step 2**  [+TLT] U+F01C5:   
 U+200D: ↑ U+F01D2:  U+200D: ↑  
 U+F01BC:  U+200D: ↑  
 U+F020E: 

feature 'ccmp', type 'gsub\_contextchain', chain lookup 's\_s\_2', replacing single U+F01C5 by U+F147F

**step 3**  [+TLT] U+F147F:   
 U+200D: ↑ U+F01D2:  U+200D: ↑  
 U+F01BC:  U+200D: ↑  
 U+F020E: 

feature 'ccmp', type 'gsub\_contextchain', chain lookup 's\_s\_3', index 1, replacing character U+200D upto U+F01D2 by ligature U+F14A7 case 4

**step 4**  [+TLT] U+F147F:   
 U+F14A7:  U+200D: ↑ U+F01BC:   
 U+200D: ↑ U+F020E: 

feature 'ccmp', type 'gsub\_contextchain', chain lookup 's\_s\_5', index 1, replacing character U+200D upto U+F01BC by ligature U+F1474 case 4

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**step 5**  [+TLT] U+F147F:  
U+F14A7: U+F1474: U+200D: ↑  
U+F020E:

feature 'ccmp', type  
'gsub\_contextchain', chain  
lookup 's\_s\_6', index 1,  
replacing character U+200D  
upto U+F020E by ligature  
U+F14C2 case 4

**step 10**  [+TLT][kern] U+F147F:  
U+F14A7: [kern] U+F1467:  
U+F14C2:

feature 'dist', type  
'gpos\_contextchain', chain  
lookup 'p\_s\_2', shifting  
single U+F147F by single  
(0pt,0pt) and correction  
(1.25pt,0pt)

**step 6**  [+TLT] U+F147F: U+F14A7:  
U+F1474: U+F14C2:

feature 'ccmp', type  
'gsub\_contextchain', chain  
lookup 's\_s\_7', replacing  
single U+F1474 by U+F1467

feature 'dist', type  
'gpos\_contextchain', chain  
lookup 'p\_s\_3', shifting  
single U+F14A7 by single  
(0pt,0pt) and correction  
(8.27148pt,0pt)

**step 7**  [+TLT] U+F147F: U+F14A7:  
U+F1467: U+F14C2:

feature 'dist', type  
'gpos\_single', lookup  
'p\_s\_0', shifting single  
U+F147F by single xy  
(1.25pt,0pt) and wh  
(0pt,0pt)

**step 11**  [+TLT][kern] U+F147F:  
[kern] U+F14A7: [kern]  
U+F1467: U+F14C2:

feature 'dist', type  
'gpos\_contextchain', chain  
lookup 'p\_s\_5', shifting  
single U+F147F by single  
(0pt,0pt) and correction  
(-4.76074pt,0pt)

**step 8**  [+TLT] U+F147F: U+F14A7:  
U+F1467: U+F14C2:

feature 'dist', type  
'gpos\_single', lookup  
'p\_s\_1', shifting single  
U+F14A7 by single xy  
(0pt,0pt) and wh  
(1.25pt,0pt)

**step 12**  [+TLT][kern] U+F147F:  
[kern][kern] U+F14A7: [kern]  
U+F1467: U+F14C2:

feature 'mark', type  
'gpos\_mark2base', lookup  
'p\_s\_27', bound 1, anchoring  
mark U+F1467 to basechar  
U+F14A7 => (6.32812pt,0pt)

**step 9**  [+TLT] U+F147F:  
U+F14A7: [kern] U+F1467:  
U+F14C2:

feature 'dist', type

**step 13**  [+TLT][kern] U+F147F:  
[kern][kern] U+F14A7: [kern]  
U+F1467: U+F14C2:

feature 'mark', type  
'gpos\_mark2base', lookup  
'p\_s\_28', bound 2, anchoring  
mark U+F14C2 to basechar  
U+F14A7 => (0.00977pt,0pt)

**result**  [+TLT][kern] U+F147F:  
[kern][kern] U+F14A7: [kern]  
U+F1467: U+F14C2:

A black and white example is the following family woman girl:

**font** 70: seguiemj.ttf @ 10.0pt

**features** [basic: ccmp=yes, dist=yes, mark=yes, mkmk=yes, script=dflt, tlig=yes, trep=yes] [extra: analyze=yes, autolanguage=position, autoscript=position, checkmarks=yes, curs=yes, devanagari=yes, dummies=yes, extensions=yes, extrafeatures=yes, extraprivates=yes, kern=yes, liga=yes, mathkerns=yes, mathrules=yes, mode=node, spacekern=yes, visualspace=yes]

**step 1**  [+TLT] U+1F469:  
U+200D: ↑ U+1F467:

feature 'ccmp', type  
'gsub\_contextchain', chain  
lookup 's\_s\_4', replacing  
single U+1F469 by U+F149D

**step 2**  [+TLT] U+F149D: U+200D: ↑  
U+1F467:

feature 'ccmp', type  
'gsub\_contextchain', chain  
lookup 's\_s\_5', index 1,  
replacing character U+200D  
upto U+1F467 by ligature  
U+F146B case 4

**step 3**  [+TLT] U+F149D: U+F146B:

feature 'dist', type  
'gpos\_single', lookup  
'p\_s\_1', shifting single  
U+F149D by single xy  
(0pt,0pt) and wh  
(1.25pt,0pt)

**step 4**  [+TLT] U+F149D: [kern]  
U+F146B:

feature 'dist', type  
'gpos\_contextchain', chain  
lookup 'p\_s\_4', shifting  
single U+F149D by single  
(1.25pt,0pt) and correction  
(0pt,0pt)

feature 'dist', type  
'gpos\_contextchain', chain  
lookup 'p\_s\_4', shifting  
single U+F149D by single  
(0pt,0pt) and correction  
(4.76074pt,0pt)

**step 5**  [+TLT][kern] U+F149D:  
[kern] U+F146B:

feature 'mark', type  
'gpos\_mark2base', lookup  
'p\_s\_28', bound 1, anchoring  
mark U+F146B to basechar  
U+F149D => (0.00977pt,0pt)

**result**  [+TLT][kern] U+F149D:  
[kern] U+F146B:

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I will not show all emoji, just the subset that contains the word woman in the description. As you can see the persons in the sequences are separated by a zero-width-joiner. There are some curious ones, for instance a woman wearing turban which in terms of UNICODE input is a female combine with a turban wearing man that becomes a beardless woman wearing a turban. Woman vampires and zombies are not supported so these are male properties.

					woman girl
					family woman
					woman girl boy
					family woman
					woman girl girl
					kiss woman man
					kiss woman woman
					man and woman holding hands
					old woman
					pregnant woman
		blondhaired woman			woman
		couple with heart woman man			woman artist
		couple with heart woman woman			woman astronaut
		family man woman boy			woman bald
		family man woman boy boy			woman biking
		family man woman girl			woman boot
		family man woman girl boy			woman bouncing ball
		family man woman girl girl			woman bowling
		family woman boy			woman cartwheeling
		family woman boy boy			woman climbing
		family woman girl			woman clothes
		family woman girl boy			woman construction worker
		family woman girl girl			woman cook
		family woman woman boy			woman curly haired
		family woman woman boy boy			woman dancing
		family woman			woman detective
					woman elf
					woman facepalming
					woman factory worker
					woman fairy

		woman farmer			officer
		woman firefighter			woman pouting
		woman flat shoe			woman raising hand
		woman frowning			woman red haired
		woman genie			woman rowing boat
		woman gesturing no			woman running
		woman gesturing ok			woman sandal
		woman getting haircut			woman scientist
		woman getting massage			woman shrugging
		woman golfing			woman singer
		woman guard			woman student
		woman hat			woman superhero
		woman health worker			woman supervillain
		woman in lotus position			woman surfing
		woman in steamy room			woman swimming
		woman judge			woman teacher
		woman juggling			woman technologist
		woman lifting weights			woman tipping hand
		woman mage			woman vampire
		woman mechanic			woman walking
		woman mountain biking			woman wearing turban
		woman office worker			woman white haired
		woman pilot			woman with headscarf
		woman playing handball			woman zombie
		woman playing water polo			
		woman police			

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So what if you don't like these colors? Because we're dealing with  $\text{T}_{\text{E}}\text{X}$  you can assume that if there is some way around the fixed color sets, then it will be provided. So, when you use  $\text{ConT}_{\text{E}}\text{Xt}$ , here is a way to overload them:

```
\definecolor[emoji-red][r=.4]
\definecolor[emoji-green][g=.4]
\definecolor[emoji-blue][b=.4]
\definecolor[emoji-yellow][r=.4,g=.4]
\definecolor[emoji-gray][s=1,t=.5,a=1]

\definefontcolorpalette[emoji-s]
[black,emoji-gray]
\definefontcolorpalette[emoji-r]
[emoji-red,emoji-gray]
\definefontcolorpalette[emoji-g]
[emoji-green,emoji-gray]
\definefontcolorpalette[emoji-b]
[emoji-blue,emoji-gray]
\definefontcolorpalette[emoji-y]
[emoji-yellow,emoji-gray]

\definefontfeature[seguiemj-s]
[ccmp=yes,dist=yes,colr=emoji-s]
\definefontfeature[seguiemj-r]
[ccmp=yes,dist=yes,colr=emoji-r]
\definefontfeature[seguiemj-g]
[ccmp=yes,dist=yes,colr=emoji-g]
\definefontfeature[seguiemj-b]
[ccmp=yes,dist=yes,colr=emoji-b]
\definefontfeature[seguiemj-y]
[ccmp=yes,dist=yes,colr=emoji-y]

\definefont[MyEmojiS]
[seguiemj*seguiemj-s]
\definefont[MyEmojiR]
[seguiemj*seguiemj-r]
\definefont[MyEmojiG]
[seguiemj*seguiemj-g]
\definefont[MyEmojiB]
[seguiemj*seguiemj-b]
\definefont[MyEmojiY]
[seguiemj*seguiemj-y]
```



Figure 4: Overloading colors by plugging in a sequence of alternate colors.

In figure 4 we see how this is applied. You can provide as many colors as needed but when you don't provide enough the last one is used. This way we get the overlaid transparent colors in the examples. By using transparency we don't obscure shapes.

The emojiopedia mentions "Asked about the design, MICROSOFT told emojiopedia that one of the reasons for the thick stroke was to allow each emoji to be easily read on any background color." The first glyph in the stack seems to do the trick, so just make sure that it doesn't become white. And, before I read that remark, while preparing a presentation with a colored background, I had already noticed that using a background was no problem. This font definitely sets the standard.

How do we know what colors are used? The next table shows the first color palette of `seguiemj`. There are quite some colors so defining your own definitely involved some studying.

1	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	32	33	34	35
	36	37	38	39	40	41	42
	43	44	45	46	47	48	49
	50	51	52	53	54	55	56
	57	58	59	60	61	62	63
	64	65	66	67	68	69	70
	71	72	73	74	75	76	77
	78	79	80	81	82	83	84
	85	86	87	88	89	90	91
	92	93	94	95	96	97	98
	99	100	101	102	103	104	105
	106	107	108	109	110	111	112
	113	114	115	116	117	118	119
	120	121	122	123	124	125	126
	127	128	129	130	131	132	133
	134	135	136	137	138	139	140
	141	142	143	144	145	146	147
	148	149	150	151	152	153	154
	155	156	157	158	159	160	161
	162	163	164	165	166	167	168
	169	170	171	172	173	174	175

Normally special symbols are accessed in ConTeXt with the `symbol` command where symbols are organized in symbol sets. This is a rather old mechanism and dates from the time that fonts were limited in coverage and symbols were collected in special fonts. The emoji are accessed by their own command: `\emoji`. The font used has the font synonym `emoji` so you need to set that one first:

```
\definefontsynonym
  [emoji]
  [seguiemj*seguiemj-cl]
```

Here is an example:

```
\emoji{woman light skin tone}\quad
\emoji{woman scientist}\quad
{\bfd bigger
 \emoji{man health worker}}
```

or typeset:   **bigger** 

The emoji symbol scales with the normal running font. When you ask for a family with skin toned members the lookup can result in another match (or no match) because one never knows to what extend a font supports it.

- `\expandedemoji` the sequence constructed from the given string
- `\resolvedemoji` a protected sequence constructed from the given string
- `\checkedemoji` an typeset sequence with unresolved modifiers and joiners removed
- `\emoji` a typeset resolved sequence using the `emoji` font synonym
- `\robustemoji` a typeset checked sequence using the `emoji` font synonym

In case you wonder how some of the details above were typeset, there is a module `fonts-emoji` that provides some helpers for introspection.

- `\ShowEmoji` show all the emoji in the current font
- `\ShowEmojiSnippets` show the snippets of a given emoji
- `\ShowEmojiSnippetsOverlay` show the overlaid snippets of a given emoji
- `\ShowEmojiGlyphs` show the snippets of a typeset emoji
- `\ShowEmojiPalettes` show the color palettes in the current font

Examples of usage are:

```
\ShowEmojiSnippets
  [family man woman girl boy]
\ShowEmojiGlyphs
  [family man woman baby girl]
\ShowEmoji
  [^man]
\ShowEmoji
\ShowEmojiPalettes
\ShowEmojiPalettes[1]
```

A good source of information about emoji is the mentioned [emojipedia.org](http://emojipedia.org) website. There you find not only details about all these symbols but also has some history. It compares updates in fonts too. It mentions for instance that in the creative update of Windows 10, some persons grew beards in the `seguiemj` font and others lost an eye. Now, if you look at the snippets shown before, you can wonder if that eye is really gone. Maybe the color is wrong or the order of stacking is not right. I decided not to waste time looking into that.

Another quote: "Support for color emoji presentation on MS WINDOWS is limited. Many applications on MS WINDOWS display emojis with a black and white text presentation instead of their color version." Well, we can do better with  $\TeX$ , but as usual not that many people really care about that. But it's fun anyway.

We end with a warning. When you use 'ligatures' like this, you really need to check the outcome. For instance, when MICROSOFT updated the font end 2017, same gender couples got different hair style for the individuals so that one can still distinguish them. However, kissing couples and couples in love (indicated by a heart) seem to be removed. Who knows how and when politics creep into fonts: is public mixed couple kissing permitted, do we sup-

port families with any mix of gender, is associating pink with girls okay or not, how do we distinguish male and female anyway? In figure 5 we see the same combination twice, the early 2017 rendering versus the late 2017 rendering. Can you notice the differences?

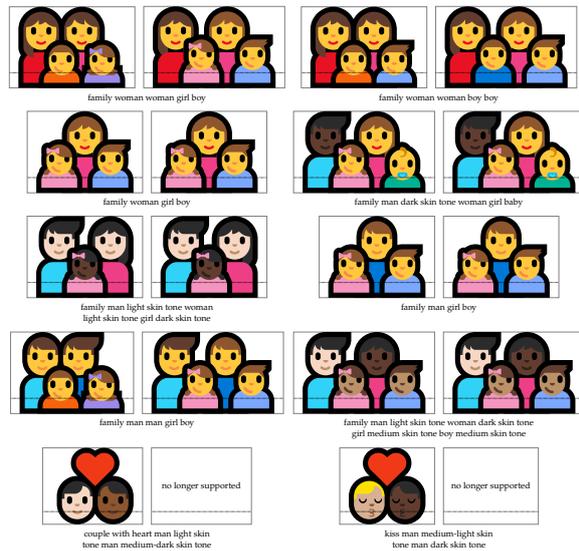


Figure 5: Incompatible updates.