

# The Lua-UL package\*

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## 1 User-level interface

Lua-UL uses new capabilities of the LuaTeX engine to provide underlining/strikethrough/highlighting etc. support without breaking ligatures, kerning or restricting input. The predefined user-level commands are `\underLine`, `\highLight`, and `\strikeThrough`. (`\highLight` will only work correctly if the `luacolor` package is loaded) They are used as

```
\documentclass{article}
\usepackage{lua-ul}
\begin{document}
This package is \strikeThrough{useless}\underLine{awesome}!
\end{document}
```

This package is ~~useless~~awesome!

For limited compatibility with `soul`, the `soul` package option allows you to use the traditional macro names from `soul` instead:

```
\documentclass{article}
\usepackage[soul]{lua-ul}
\begin{document}
This package is \st{useless}\ul{awesome}!
\end{document}
```

The `\highLight` command highlights the argument in yellow by default. This color can be changed either by providing a color as optional argument or by changing the default through `\LuaULSetHighLightColor`:

---

\*This document corresponds to Lua-UL v0.0.4, dated 2020/03/31.

```

\documentclass{article}
\usepackage{xcolor,luacolor,lua-ul}
\LuaULSetHighLightColor{green}
\begin{document}
Lots of stuff is \highLight{important enough to be highlighted},
but only few things are dangerous enough to deserve
\highLight[red]{red highlighting.}

\LuaULSetHighLightColor{yellow}
Let's go back to traditional \highLight{highlighting}.
\end{document}

```

Lots of stuff is important enough to be highlighted, but only few things are dangerous enough to deserve red highlighting.  
 Let's go back to traditional highlighting.

## 2 Expert interface

**\newunderlinetype** Sometimes, you might try to solve more interesting problems than boring underlining, strikethrough or highlighting. Maybe you always wanted to be your own spell checker, want to demonstrate your love for ducks or you think that the traditional `\strikeThrough` is not/visibly enough. For all these cases, you can define your own “underlining” command based on a TeX `\[c]leaders` command.

For this, use

**\newunderlinetype***<macro name>*[*<context specifier>*]{*<\leaders command>*}

First, you have to pass the name of the command which should enable your new kind of underlining. (If you want to have an additional command which takes an argument and underlines this argument, you will have to define this manually.) The optional argument provides a “context”: This “context” has to expand to a string (something that can appear in a csname) which changes if the leaders box should be recalculated. The leader will be cached and reused whenever the context evaluates to the same string. So if your leaders should depend on the fontsize, the expansion of the context should contain the font size. If you leaders contain text in the current font, your context should include `\fontname`. The default context includes the current size of `1ex` and the current color if `luacolor` is loaded.

The final argument contains the actual leader command. You should omit the final glue normally passed to `\leaders`, so e.g. write `\leaders\hbox{ . }` without appending `\hfill` or `\hskip1pt` etc. In most cases, the height and depth of your underlines is passed on to TeX to ensure that a deep underline does not interpret other lines. On the other hand, running dimensions work fine if you use a rule.

For example, the special underline commands demonstrated above are implemented as

```
\usepackage{luacolor,tikzducks,pict2e}
\newunderlinetype\beginUnderDuck{\cleaders\hbox{%
  \begin{tikzpicture}[x=.5ex,y=.5ex,baseline=.8ex]%
    \duck
  \end{tikzpicture}}%
}}
\newcommand\underDuck[1]{\beginUnderDuck#1}}
\newunderlinetype\beginUnderWavy[\number\dimexpr1ex]{\cleaders\hbox{%
  \setlength\unitlength{.3ex}%
  \begin{picture}(4,0)(0,1)
    \thicklines
    \color{red}%
    \qbezier(0,0)(1,1)(2,0)
    \qbezier(2,0)(3,-1)(4,0)
  \end{picture}}%
}}
\newcommand\underWavy[1]{\beginUnderWavy#1}}
\newunderlinetype\beginStrikeThough{\leaders\hbox{%
  \normalfont\bfseries/%
}}
\newcommand\StrikeThough[1]{\beginStrikeThough#1}}
```

Here `\underWavy` uses a custom context because it doesn't change depending on the current font color.

If you only want to use `\newunderlinetype` and do not want to use the predefined underline types, you can use the `minimal` package option to disable them.

## 3 The implementation

### 3.1 Helper modules

First we need a separate Lua module `pre_append_to_vlist_filter` which provides a variant of the `append_to_vlist_filter` callback which can be used by multiple packages. This ensures that we are compatible with other packages implementing `append_to_vlist_filter`. First check if an equivalent to `pre_append_to_vlist_filter` already exists. The idea is that this might eventually get added to the kernel directly.

```
if luatexbase.callbacktypes.pre_append_to_vlist_filter then
  return
end

local call_callback = luatexbase.call_callback
local flush_node = node.flush_node
```

```

local prepend_prevdepth = node.prepend_prevdepth
local callback_define

```

HACK: Do not do this at home! We need to define the engine callback directly, so we use the debug library to get the “real” `callback.define`:

```

for i=1,5 do
  local name, func = debug.getupvalue(luatexbase.disable_callback, i)
  if name == 'callback_register' then
    callback_define = func
    break
  end
end
if not callback_define then
  error[[Unable to find callback.define]]
end

local function filtered_append_to_vlist_filter(box,
                                              locationcode,
                                              prevdepth,
                                              mirrored)

  local current = call_callback("pre_append_to_vlist_filter",
                                box, locationcode, prevdepth,
                                mirrored)

  if not current then
    flush_node(box)
    return
  elseif current == true then
    current = box
  end
  return call_callback("append_to_vlist_filter",
                      current, locationcode, prevdepth, mirrored)
end

callback_define('append_to_vlist_filter',
               filtered_append_to_vlist_filter)
luatexbase.callbacktypes.append_to_vlist_filter = nil
luatexbase.create_callback('append_to_vlist_filter', 'exclusive',
                          function(n, _, prevdepth)
                            return prepend_prevdepth(n, prevdepth)
                          end)
luatexbase.create_callback('pre_append_to_vlist_filter',
                          'list', false)

```

## 3.2 Lua module

Now we can define our main Lua module:

```

local unset_t = node.id'unset'
local hlist_t = node.id'hlist'
local vlist_t = node.id'vlist'

```

```

local kern_t = node.id'kern'
local glue_t = node.id'glue'

local properties = node.direct.get_properties_table()

local has_attribute = node.direct.has_attribute
local set_attribute = node.direct.set_attribute
local dimensions = node.direct.dimensions
local flush_node = node.direct.flush_node
local getboth = node.direct.getboth
local getfield = node.direct.getfield
local getglue = node.direct.getglue
local getleader = node.direct.getleader
local getlist = node.direct.getlist
local setheight = node.direct.setheight
local setdepth = node.direct.setdepth
local getheight = node.direct.getheight
local getdepth = node.direct.getdepth
local getnext = node.direct.getnext
local getshift = node.direct.getshift
local insert_after = node.direct.insert_after
local insert_before = node.direct.insert_before
local nodecopy = node.direct.copy
local nodenew = node.direct.new
local setboth = node.direct.setboth
local setlink = node.direct.setlink
local hpack = node.direct.hpack
local setfield = node.direct.setfield
local slide = node.direct.slide
local setglue = node.direct.setglue
local setnext = node.direct.setnext
local setshift = node.direct.setshift
local todirect = node.direct.todirect
local tonode = node.direct.tonode
local traverse = node.direct.traverse
local traverse_id = node.direct.traverse_id
local traverse_list = node.direct.traverse_list
% The following two are needed to deal with unset nodes
local getList = function(n) return getfield(n, 'list') end
local setList = function(n, h) return setfield(n, 'list', h) end

local tokennew = token.new
local set_lua = token.set_lua
local scan_keyword = token.scan_keyword
local scan_list = token.scan_list
local scan_int = token.scan_int
local put_next = token.put_next
local texerror = tex.error

local char_given = token.command_id'char_given'

```

```

local underlineattrs = {}
local underline_types = {}
local underline_strict_flag = {}
local underline_over_flag = {}

local vmode do
  for k, v in pairs(tex.getmodevalues()) do
    if v == "vertical" then
      vmode = k
      break
    end
  end
end
local texnest = tex.nest

local saved_values = {}
local function new_underline_type()
  for i=1,#underlineattrs do
    local attr = underlineattrs[i]
    saved_values[i] = tex.attribute[attr]
    tex.attribute[attr] = -0x7FFFFFFF
  end
  local strict_flag = scan_keyword'strict'
  local over_flag = scan_keyword'over'
  local b = todirect(scan_list())
  for i=1,#underlineattrs do
    tex.attribute[underlineattrs[i]] = saved_values[i]
  end
  local lead = getlist(b)
  if not getleader(lead) then
    texerror("Leader required", {"An underline type has to \z
      be defined by leader. You should use one of the", "commands \z
      \\leaders, \\cleaders, or \\xleader, or \\gleaders here."})
  else
    local after = getnext(lead)
    if after then
      texerror("Too many nodes", {"An underline type can only be \z
        defined by a single leaders specification,", "not by \z
        multiple nodes. Maybe you supplied an additional glue?",
        "Anyway, the additional nodes will be ignored"})
      setnext(lead, nil)
    end
    table.insert(underline_types, lead)
    setList(b, after)
    flush_node(b)
  end
end
put_next(tokennew(#underline_types, char_given))
underline_strict_flag[#underline_types] = strict_flag
underline_over_flag[#underline_types] = over_flag

```

end

In `append_to_vlist_filter` we can not access the list attributes, so we just take the current ones. They might be incorrect if the attribute changes in the vlist, so we record the original value in a property then.

```

local function set_underline()
  local j, props
  for i=texnest.ptr,0,-1 do
    local mode = texnest[i].mode
    if mode == vmode or mode == -vmode then
      local head = todirect(texnest[i].head)
      local head_props = properties[head]
      if not head_props then
        head_props = {}
        properties[head] = head_props
      end
      props = head_props.luaul_attributes
      if not props then
        props = {}
        head_props.luaul_attributes = props
        break
      end
    end
  end
  for i=1,#underlineattrs do
    local attr = underlineattrs[i]
    if tex.attribute[attr] == -0x7FFFFFFF then
      j = attr
      break
    end
  end
  if not j then
    j = luatexbase.new_attribute(
      "luaul" .. tostring(#underlineattrs+1))
    underlineattrs[#underlineattrs+1] = j
  end
  props[j] = props[j] or -0x7FFFFFFF
  tex.attribute[j] = scan_int()
end

local function reset_underline()
  local reset_all = scan_keyword'*'
  local j
  for i=1,#underlineattrs do
    local attr = underlineattrs[i]
    if tex.attribute[attr] ~= -0x7FFFFFFF then
      if reset_all then
        tex.attribute[attr] = -0x7FFFFFFF
      else
        j = attr
      end
    end
  end
end

```

```

        end
    end
end
if not j then
    if not reset_all then
        texerror("No underline active", {"You tried to disable \z
            underlining but underlining was not active in the first",
            "place. Maybe you wanted to ensure that \z
            no underling can be active anymore?", "Then you should \z
            append a *."})
    end
    return
end
tex.attribute[j] = -0x7FFFFFFF
end
local functions = lua.get_functions_table()
local new_underline_type_func =
    luatexbase.new_luafunction"luaul.new_underline_type"
local set_underline_func =
    luatexbase.new_luafunction"luaul.set_underline_func"
local reset_underline_func =
    luatexbase.new_luafunction"luaul.reset_underline_func"
set_lua("LuaULNewUnderlineType", new_underline_type_func)
set_lua("LuaULSetUnderline", set_underline_func, "protected")
set_lua("LuaULResetUnderline", reset_underline_func, "protected")
functions[new_underline_type_func] = new_underline_type
functions[set_underline_func] = set_underline
functions[reset_underline_func] = reset_underline

```

A little helper to measure box contents and creating a glue node with inverted dimensions.

```

local stretch_fi = {}
local shrink_fi = {}
local function fil_levels(n)
    for i=0,4 do
        stretch_fi[i], shrink_fi[i] = 0, 0
    end
    for n in traverse_id(glue_t, n) do
        local w, st, sh, sto, sho = getglue(n)
        stretch_fi[sto] = stretch_fi[sto] + st
        shrink_fi[sho] = shrink_fi[sho] + sh
    end
    local stretch, shrink = 0, 0
    for i=0,4 do
        if stretch_fi[i] ~= 0 then
            stretch = i
        end
        if shrink_fi[i] ~= 0 then
            shrink = i
        end
    end
end

```



```

        end
    end
    return stretch, shrink
end
local function new_glue_neg_dimensions(n, t,
                                     stretch_order, shrink_order)

    local g = nodenew(glue_t)
    local w = -dimensions(n, t)
    setglue(g, w)
%   setglue(g, -dimensions(n, t), 0, 0, stretch_order, shrink_order)
    setnext(g, n)
    setglue(g, w, -dimensions(1, 1, stretch_order, g, t),
            dimensions(1, 2, shrink_order, g, t),
            stretch_order, shrink_order)

    setnext(g, nil)
    return g
end

```

Now the actual undelining

```

local add_underline_hlist, add_underline_hbox, add_underline_vbox
local function add_underline_vlist(head, attr, outervalue)
    local iter, state, n = traverse_list(head) -- FIXME: unset nodes
    local t
    n, t = iter(state, n)
    while n ~= nil do
        local real_new_value = has_attribute(n, attr)
        local new_value = real_new_value ~= outervalue
            and real_new_value or nil
        if underline_strict_flag[new_value] or not new_value then
            if t == hlist_t then
                add_underline_hbox(n, attr, real_new_value)
            elseif t == vlist_t then
                add_underline_vbox(n, attr, real_new_value)
            end
            n, t = iter(state, n)
        elseif real_new_value <= 0 then
            n, t = iter(state, n)
        else
            local nn
            nn, t = iter(state, n)
            local prev, next = getboth(n)
            setboth(n, nil, nil)
            local shift = getshift(n)
            setshift(n, 0)
            local new_list = hpack((add_underline_hlist(n, attr)))
            setheight(new_list, getheight(n))
            setdepth(new_list, getdepth(n))
            setshift(new_list, shift)
            setlink(prev, new_list, next)
        end
    end
end

```

```

        set_attribute(new_list, attr, 0)
        if n == head then
            head = new_list
        end
        n = nn
    end
end
return head
end
function add_underline_vbox(head, attr, outervalue)
    if outervalue and outervalue <= 0 then return end
    setList(head, add_underline_vlist(getList(head), attr, outervalue))
    set_attribute(head, attr, outervalue and -outervalue or 0)
end
function add_underline_hlist(head, attr, outervalue)
    local max_height, max_depth
    slide(head)
    local last_value
    local first
    local shrink_order, stretch_order
    for n, id, subtype in traverse(head) do
        local real_new_value = has_attribute(n, attr)
        local new_value
        if real_new_value then
            if real_new_value > 0 then
                set_attribute(n, attr, -real_new_value)
                new_value = real_new_value ~= outervalue
                    and real_new_value or nil
            end
        else
            set_attribute(n, attr, 0)
        end
        if id == hlist_t then
            if underline_strict_flag[new_value]
                or subtype == 3 or not new_value then
                add_underline_hbox(n, attr, real_new_value)
                new_value = nil
            end
        elseif id == vlist_t then
            if underline_strict_flag[new_value] or not new_value then
                add_underline_vbox(n, attr, real_new_value)
                new_value = nil
            end
        elseif id == kern_t and subtype == 0 then
            local after = getnext(n)
            if after then
                local next_value = has_attribute(after, attr)
                if next_value == outervalue or not next_value then
                    new_value = nil
                else

```

```

        new_value = last_value
    end
else
    new_value = last_value
end
elseif id == glue_t and (
    subtype == 8 or
    subtype == 9 or
    subtype == 15 or
false) then
    new_value = nil
end
if last_value ~= new_value then
    if not stretch_order then
        stretch_order, shrink_order = fil_levels(head)
    end
    if last_value then
        local glue = new_glue_neg_dimensions(first, n,
            stretch_order, shrink_order)
        local w, st, sh = getglue(glue)
        local lead = nodecopy(underline_types[last_value])
        setglue(lead, -w, -st, -sh, stretch_order, shrink_order)
        if underline_over_flag[last_value] then
            head = insert_before(head, n, glue)
            insert_after(head, glue, lead)
        else
            head = insert_before(head, first, lead)
            insert_after(head, lead, glue)
        end
    end
end
if new_value then
    first = n
    local box = getleader(underline_types[new_value])
    if not max_height or getheight(box) > max_height then
        max_height = getheight(box)
    end
    if not max_depth or getdepth(box) > max_depth then
        max_depth = getdepth(box)
    end
end
last_value = new_value
end
end
if last_value then
    local glue = new_glue_neg_dimensions(first, nil,
        stretch_order, shrink_order)
    local w, st, sh = getglue(glue)
    local lead = nodecopy(underline_types[last_value])
    setglue(lead, -w, -st, -sh, stretch_order, shrink_order)
    if underline_over_flag[last_value] then

```

```

        insert_before(head, nil, glue)
        insert_after(head, glue, lead)
    else
        head = insert_before(head, first, lead)
        insert_after(head, lead, glue)
    end
end
end
return head, max_height, max_depth
end
function add_underline_hbox(head, attr, outervalue, set_height_depth)
    if outervalue and outervalue <= 0 then return end
    local new_head, new_height, new_depth
    = add_underline_hlist(getList(head), attr, outervalue)
    setList(head, new_head)
    if set_height_depth then
        if new_height and getheight(head) < new_height then
            setheight(head, new_height)
        end
        if new_depth and getdepth(head) < new_depth then
            setdepth(head, new_depth)
        end
    end
    set_attribute(head, attr, outervalue and -outervalue or 0)
end
require 'pre_append_to_vlist_filter'
luatexbase.add_to_callback('pre_append_to_vlist_filter',
    function(b, loc, prev, mirror)
        local props = properties[todirect(texnest.top.head)]
        props = props and props.luaul_attributes
        b = todirect(b)
        if loc == "post_linebreak" then
            for i = 1, #underlineattrs do
                local attr = underlineattrs[i]
                local current = props and props[attr] or tex.attribute[attr]
                if current == -0x7FFFFFFF then
                    current = nil
                end
                add_underline_hbox(b, underlineattrs[i], current, true)
            end
        else
            for i = 1, #underlineattrs do
                local attr = underlineattrs[i]
                local current = props and props[attr] or tex.attribute[attr]
                local b_attr = has_attribute(b, attr)
                if b_attr and b_attr ~= current then
                    local shift = getshift(b)
                    setshift(b, 0)
                    b = hpack((add_underline_hlist(b, attr)))
                    setshift(b, shift)
                    set_attribute(b, attr, 0)
                end
            end
        end
    end
end

```

```

        end
    end
end
return tonode(b)
end, 'add underlines to list')
luatexbase.add_to_callback('hpack_filter',
function(head, group, size, pack, dir, attr)
    head = todirect(head)
    for i = 1, #underlineattrs do
        local ulattr = underlineattrs[i]
        local current
        for n in node.traverse(attr) do
            if n.number == ulattr then
                current = n.value
            end
        end
        head = add_underline_hlist(head, ulattr, current)
    end
    return tonode(head)
end, 'add underlines to list')
luatexbase.add_to_callback('vpack_filter',
function(head, group, size, pack, maxdepth, dir, attr)
%     if true then return head end
    head = todirect(head)
    for i = 1, #underlineattrs do
        local ulattr = underlineattrs[i]
        local current
        for n in node.traverse(attr) do
            if n.number == ulattr then
                current = n.value
            end
        end
        head = add_underline_vlist(head, ulattr, current)
    end
    return tonode(head)
end, 'add underlines to list')

```

### 3.3 T<sub>E</sub>X support package

Now only some L<sup>A</sup>T<sub>E</sub>X glue code is still needed. Only LuaL<sup>A</sup>T<sub>E</sub>X is supported. For other engines we show an error.

```

\ifx\directlua\undefined
  \PackageError{lua-ul}{LuaLaTeX required}%
  {Lua-UL requires LuaLaTeX.
   Maybe you forgot to switch the engine in your editor?}
\fi
\directlua{require'lua-ul'}
\RequirePackage{xparse}

```

We support some options. Especially `minimal` will disable the predefined com-

mands `\underline` and `\strikeThrough` and allow you to define similar commands with your custom settings instead, `soul` tries to replicate names of the `soul` package.

```
\newif\ifluaul@predefined
\newif\ifluaul@soulnames
\luaul@predefinedtrue
\DeclareOption{minimal}{\luaul@predefinedfalse}
\DeclareOption{soul}{\luaul@soulnamestrue}
\ProcessOptions\relax
```

Just one more tiny helper.

```
\protected\def\luaul@maybedefineuse#1#2{%
  \unless\ifcsname#1\endcsname
    \expandafter\xdef\csname#1\endcsname{#2}%
  \fi
  \csname#1\endcsname
}
```

The default for the context argument. Give that most stuff should scale vertically with the font size, we expect most arguments to be given in `ex`. Additionally especially traditional underlines will use the currently active text color, so especially when `luacolor` is loaded we have to include the color attribute too.

```
\newcommand\luaul@defaultcontext{%
  \number\dimexpr1ex
  \@unless\ifx\undefined\LuaCol@Attribute
    \the\LuaCol@Attribute
  \fi
}
```

The main macro.

```
\NewDocumentCommand\newunderlinetype
  { E{*}{} } m O{\luaul@defaultcontext} m {}{%
  \newcommand#2{}% "Reserve" the name
  \protected\def#2{%
    \expandafter\luaul@maybedefineuse
    \expanded{\csstring#2@#3}%
    {\LuaULSetUnderline
     \LuaULNewUnderlineType#1\hbox{#4\hskip0pt}%
    }}%
  }
\ifluaul@predefined
```

For `\highLight`, the color should be customizable. There are two cases: If `xcolor` is not loaded, we just accept a simple color name. Otherwise, we accept color as documented in `xcolor` for `PSTricks`: Either a color name, a color expression or a combination of `colormodel` and associated values.

```
\newcommand\luaul@highlight@color{yellow}
\def\luaul@@setcolor\xcolor@#1#2{%
\newcommand\luaul@setcolor[1]{%
  \ifx\XC@getcolor\undefined
```

```

\def\luaul@highlight@currentcolor{#1}
\else
\beginingroup
\XC@getcolor{#1}\luaul@tmpcolor
\expanded{\endgroup
\def\noexpand\luaul@highlight@currentcolor{%
\expandafter\luaul@@setcolor\luaul@tmpcolor}}%
\fi
}

```

Now a user-level command to set the default color.

```

\NewDocumentCommand\LuaULSetHighLightColor{om}{%
\edef\luaul@highlight@color{\IfValueTF{#1}{\luaul@highlight@color{#1}}{\luaul@highlight@color{#2}}}%
}

```

The sizes for the predefined commands are stolen from the “soul” default values.

```

\newunderlinetype\@underLine%
{\leaders\vrule height -.65ex depth .75ex}
\newcommand\@underLine[1]{\@underLine#1}
\newunderlinetype\@strikeThrough%
{\leaders\vrule height .55ex depth -.45ex}
\newcommand\@strikeThrough[1]{\@strikeThrough#1}

\newunderlinetype\@highLight[\number\dimexpr1ex@%
\luaul@highlight@currentcolor]%
{%
\ifx\XC@getcolor\undefined
\color{\luaul@highlight@currentcolor}%
\else
\expandafter\XC@undeclaredcolor\luaul@highlight@currentcolor
\fi
\leaders\vrule height 1.75ex depth .75ex
}
\newcommand\@highLight[2][\luaul@highlight@color]{%
\luaul@setcolor{#1}%
\@highLight#2%
}}
\ifluaul@soulnames
\let\textul\@underLine \let\ul\textul
\let\textst\@strikeThrough \let\st\textst
\let\texthl\@highLight \let\hl\texthl
\fi
\fi

```

Finally patch `\reset@font` to ensure that underlines do not propagate into unexpected places.

```

\ifx \reset@font \normalfont
\let \reset@font \relax
\DeclareRobustCommand \reset@font {%
\normalfont
\LuaULResetUnderline*%
}

```

```

    }
\else
  \MakeRobust \reset@font
  \begingroup
    \expandafter \let
      \expandafter \helper
        \csname reset@font \endcsname
  \expandafter \endgroup
  \expandafter \gdef
    \csname reset@font \expandafter \endcsname
  \expandafter {%
    \helper%
    \LuaULResetUnderline*%
  }
\fi

```

## Change History

0.0.1		Patch <code>\reset@font</code> . . . . .	12
General: Initial release . . . . .	3	0.0.3	
0.0.2		General: Make streight lines over hboxes . . . . .	7
General: Add command to disable active underlining . . . .	6	Use glue instead of kern to allow handling unset lists . . . .	6
Allow <code>\highLight</code> color customization . . . . .	11		