



Brevier is a compact sans, ideal for setting long texts in small or very small type sizes: excellent for packaging, instruction booklets, drug information leaflets and anything else that has to be legible at very small sizes, even down to 3 points.

Lean and rhythmical, designed ideally to be used at less than 8 points (Brevier was the old typefounders' name for 8-point type), Brevier has a marked horizontal movement and holds up well even under adverse printing conditions. The apparently geometric letterforms hide humanistic, Renaissance characteristics, the x-height and openings are very generous and the strokes slightly modulated.

In order to offset ink spread – which is inevitable when printing very small sizes of type – Brevier has large white spaces between the letters. All internal angles have deep ink traps and many connections have been left open.

These major optical adjustments become strong and original design features in larger sizes. In fact, when printed in large sizes, Brevier letters don't resemble the same letters printed small.

A
C
x
D

B D N h a s s

CERTAIN ACCENTED CAPITALS ARE ABOUT 5% SMALLER THEN
NORMAL CAPS IN ORDER TO BETTER FIT DIACRITICAL MARKS

B B b

Regular

B b

Italic

BREVIER ITALIC DOES NOT SUPPORT SMALLCAPS

B B b

Medium

B B b

Bold

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sampling window along a line of text (for a review, see Huey, 1908/1968). Until recently, nobody has quantified this limitation on reading.

Three sensory mechanisms almost certainly affect the size of the visual spanVdecreasing letter acuity outward from the midline, crowding between adjacent letters, and decreasing accuracy of position signals in peripheral vision.

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The CPS is the point above which print size is not a limiting factor for reading speed. Chung found an interaction effect between letter spacing and print size for RSVP reading such that

a letter spacing that is smaller than the standard adversely affects smaller print size more than the larger print size. In this study, we also used two print sizes (one above and one below the CPS) to test the interaction effect of letter spacing and print size on reading speed and visual-span size. Because crowding is more prominent at the smaller print size, we expected that small letter spacings would limit the visual span and reading speed more for the smaller print size than for the larger print size.

The primary evidence that links visual span and reading speed has been obtained with the RSVP method in which eye movements are minimized (Chung et al., 1998; Legge et al., 2001; Legge, Cheung, Yu, Chung, Lee, & Owens, in press). RSVP presents words one at a time in the same position in the visual field. However, most everyday reading requires saccadic eye movements. It is possible that a linkage between reading speed and visual-span size for RSVP reading would not generalize to reading with saccades.

Characteristics of eye-movement control may influence the relationship between visual span and reading speed for everyday reading. Legge, Klitz, and Tjan (1997) and Legge, Hooven, Klitz, Mansfield, and Tjan (2002) have formulated a computational model (BMr. Chips) to simulate saccade planning with different visual-span sizes. In general, larger visual spans predict larger saccades. On the basis of this model, we would also expect to find a close linkage between the size of the visual span and saccade-based reading speed. A secondary goal of this study was to evaluate this expectation.

To summarize, we tested three predictions:

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SPACING OF LETTERS IN TEXT INFLUENCES READING SPEED IN NORMAL CENTRAL AND PERIPHERAL VISION (ARDITI, KNOBLAUCH, & GRUNWALD, 1990; CHUNG, 2002; LEGGE, RUBIN, PELLI, & SCHLESKE, 1985) AND IN LOW VISION (LEGGE ET AL., 1985). INCREASING LETTER SPACING BEYOND SEPARATIONS NORMALLY FOUND IN TEXT SLOWS READING SPEED (CHUNG, 2002; LEGGE ET AL., 1985). THIS IS SURPRISING BECAUSE INCREASED LETTER SPACING REDUCES CROWDING, THE INTERFERENCE WITH LETTER RECOGNITION FROM ADJACENT LETTERS, AND IMPROVES LETTER-IDENTIFICATION PERFORMANCE (BOUMA, 1970; CHUNG, LEVI, & LEGGE, 2001). IN THIS STUDY, WE SHOW THAT THE SIZE OF THE VISUAL SPAN (THE NUMBER OF LETTERS IN TEXT THAT CAN BE RECOGNIZED WITHOUT MOVING THE EYES) CAN ACCOUNT FOR THE OBSERVED EFFECTS OF LETTER SPACING ON READING SPEED.

CHUNG (2002) MEASURED RAPID SERIAL VISUAL PRESENTATION (RSVP) READING SPEED FOR FIVE LETTER SPACINGS AT THE FOVEA AND 5° AND 10° ECCENTRICITIES IN THE LOWER VISUAL FIELD. HER RESULTS SHOWED THAT READING SPEED IN BOTH CENTRAL AND PERIPHERAL VISION DID NOT INCREASE WITH LETTER SPACING BEYOND THE STANDARD SPACING (THE SPACING USED IN NORMAL COURIER TEXT: 1.16 TIMES THE WIDTH OF THE LOWERCASE X). IN FACT, READING SPEED IN CENTRAL VISION DECLINED AT LARGER SPACINGS. LEGGE ET AL. (1985) OBTAINED SIMILAR RESULTS BY USING THE DRIFTING-TEXT METHOD. THEY MEASURED READING SPEED WITH THREE DIFFERENT LETTER SPACINGS (1X, 1.5X, AND 2X STANDARD) FOR TWO NORMAL AND FOUR LOW-VISION PARTICIPANTS.

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SPACING OF LETTERS IN TEXT INFLUENCES READING SPEED IN NORMAL CENTRAL AND PERIPHERAL VISION (ARDITI, KNOBLAUCH, & GRUNWALD, 1990; CHUNG, 2002; LEGGE, RUBIN, PELLI, & SCHLESKE, 1985) AND IN LOW VISION (LEGGE ET AL., 1985). INCREASING LETTER SPACING BEYOND SEPARATIONS NORMALLY FOUND IN TEXT SLOWS READING SPEED (CHUNG, 2002; LEGGE ET AL., 1985). THIS IS SURPRISING BECAUSE INCREASED LETTER SPACING REDUCES CROWDING, THE INTERFERENCE WITH LETTER RECOGNITION FROM ADJACENT LETTERS, AND IMPROVES LETTER-IDENTIFICATION PERFORMANCE (BOUMA, 1970; CHUNG, LEVI, & LEGGE, 2001). IN THIS STUDY, WE SHOW THAT THE SIZE OF THE VISUAL SPAN (THE NUMBER OF LETTERS IN TEXT THAT CAN BE RECOGNIZED WITHOUT MOVING THE EYES) CAN ACCOUNT FOR THE OBSERVED EFFECTS OF LETTER SPACING ON READING SPEED.

CHUNG (2002) MEASURED RAPID SERIAL VISUAL PRESENTATION (RSVP) READING SPEED FOR FIVE LETTER SPACINGS AT THE FOVEA AND 5° AND 10° ECCENTRICITIES IN THE LOWER VISUAL FIELD. HER RESULTS SHOWED THAT READING SPEED IN BOTH CENTRAL AND PERIPHERAL VISION DID NOT INCREASE WITH LETTER SPACING BEYOND THE STANDARD SPACING (THE SPACING USED IN NORMAL COURIER TEXT: 1.16 TIMES THE WIDTH OF THE LOWERCASE X). IN FACT, READING SPEED IN CENTRAL VISION DECLINED AT LARGER SPACINGS. LEGGE ET AL. (1985) OBTAINED SIMILAR RESULTS BY USING THE DRIFTING-TEXT METHOD. THEY MEASURED READING SPEED WITH THREE DIFFERENT LETTER SPACINGS (1X, 1.5X, AND 2X STANDARD) FOR TWO NORMAL AND FOUR LOW-VISION PARTICIPANTS.

FOR ALL PARTICIPANTS, READING SPEED WAS HIGHEST FOR THE STANDARD SPACING AND DECREASED FOR LARGER SPACINGS.

THE VISUAL SPAN FOR READING

REFERS TO THE NUMBER OF ADJACENT LETTERS THAT CAN BE RECOGNIZED RELIABLY WITHOUT MOVING THE EYES. LEGGE, AHN, KLITZ, AND LUEBKER (1997) HYPOTHESIZED THAT SHRINKAGE IN THE SIZE OF THE VISUAL SPAN COULD ACCOUNT FOR SLOWER READING FOR LOW-CONTRAST TEXT. THEY MEASURED READING TIME AS A FUNCTION OF THE LENGTH OF THE WORDS USED IN RSVP READING AT DIFFERENT LUMINANCE CONTRAST LEVELS. FROM THESE READING TIME VERSUS WORD LENGTH FUNCTIONS, LEGGE, AHN, ET AL. (1997) ESTIMATED THAT THE VISUAL-SPAN SIZE DECREASED FROM 10 CHARACTERS TO 2 CHARACTERS AS CONTRAST DECREASED FROM 100% TO 5%. LEGGE, MANSFIELD, AND CHUNG (2001) INTRODUCED A MORE DIRECT METHOD FOR MEASURING THE VISUAL SPAN, BASED ON PLOTS OF LETTER-RECOGNITION ACCURACY AS A FUNCTION OF DISTANCE LEFT AND RIGHT OF THE MIDLINE. THESE PLOTS WERE TERMED VISUAL-SPAN PROFILES. (THIS METHOD IS DESCRIBED IN THE METHODS SECTION.) THESE AUTHORS SHOWED THAT VISUAL-SPAN PROFILES SHRINK IN SIZE IN PERIPHERAL VISION, POTENTIALLY ACCOUNTING FOR THE CORRESPONDING DECLINE OF READING SPEED IN PERIPHERAL VISION (CHUNG, MANSFIELD, & LEGGE, 1998). LEGGE ET AL. (2001) ALSO FORMULATED A COMPUTATIONAL MODEL THAT LINKS THE SIZE OF THE VISUAL-SPAN PROFILES TO RSVP READING SPEED AND PROPOSED THAT THE SIZE OF THE VISUAL SPAN IMPOSES A BOTTLE-NECK ON READING SPEED.

THE CONCEPT OF VISUAL SPAN EXPRESSES THE INTUITIVELY PLAUSIBLE IDEA THAT READING SPEED IS INFLUENCED BY THE NUMBER OF LETTERS THAT CAN BE RECOGNIZED ON ONE GLANCE; IT IS A KIND OF BWINDOW SIZE[LIMITATION OR SAMPLING LIMITATION ON READING. THIS GENERAL IDEA HAS BEEN WIDELY ACCEPTED AS A QUALITATIVE LIMITATION ON READING

Spacing of letters in text influences reading speed in normal central and peripheral vision (Arditi, Knoblauch, et Grunwald, 1990; Chung, 2002; Legge, Rubin, Pelli, et Schleske, 1985) and in low vision (Legge et al., 1985). Increasing letter spacing beyond separations normally found in text slows reading speed (Chung, 2002; Legge et al., 1985). This is surprising because increased letter spacing reduces crowding, the interference with letter recognition from adjacent letters, and improves letter-identification performance (Bouma, 1970; Chung, Levi, et Legge, 2001). In this study, we show that the size of the visual span (the number of letters in text that can be recognized without moving the eyes) can account for the observed effects of letter spacing on reading speed.

Chung (2002) measured rapid serial visual presentation (RSVP) reading speed for five letter spacings at the fovea and 5° and 10° eccentricities in the lower visual field. Her results showed that reading speed in both central and peripheral vision did not increase with letter spacing beyond the standard spacing (the spacing used in normal Courier text: 1.16 times the width of the lowercase x). In fact, reading speed in central vision declined at larger spacings. Legge et al. (1985) obtained similar results by using the drifting-text method. They measured reading speed with three different letter spacings (1x, 1.5x, and 2x standard) for two normal and four low-vision participants.

For all participants, reading speed was highest for the standard spacing and decreased for larger spacings.

The visual span for reading refers to the number of adjacent letters that can be recognized reliably without moving the eyes. Legge, Ahn, Klitz, and Luebker (1997) hypothesized that shrinkage in the size of the visual span could account for slower reading for low-contrast

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Three sensory mechanisms almost certainly affect the size of the visual span: decreasing letter acuity outward from the midline, crowding between adjacent letters, and decreasing accuracy of position signals in peripheral vision.

The roles of these factors in determining the size of the visual span have been reviewed by Legge (2007). Increased letter spacing reduces crowding, but it also extends the text further into peripheral vision, which has reduced acuity and reduced positional accuracy. A priori, it is not clear how an increase in letter spacing would affect the size of the visual span for reading. According to the hypothesis that visual span is the primary sensory limitation on reading speed, we predicted that reading speed should show the same dependence on letter spacing as visual-span size. The primary goal of this study was to test this prediction in central vision by measuring both the size of the visual span and reading speed as a function of letter spacing.

Arditi et al. (1990) have argued that crowding occurs in central vision near the acuity limit. If spacing effects are due to crowding, we would expect more pronounced spacing effects for print sizes near the acuity limit. To test this idea, Chung (2002) used two print sizes in her study: one larger and one smaller than the critical print size (CPS).

The CPS is the point above which print size is not a limiting factor for reading speed. Chung found an interaction effect between letter spacing and print size for RSVP reading such that a letter spacing that is smaller than the standard adversely affects smaller print size more than the larger print size. In this study, we also used two print sizes (one above and one below the CPS) to test the interaction effect of letter spacing and print size on reading speed and visual-span size. Because crowding is more prominent at the smaller print size, we expected that small letter spacings would limit the visual span and reading speed more for the smaller print size than for the larger print size.

The primary evidence that links visual span and reading speed has been obtained with the RSVP

method in which eye movements are minimized (Chung et al., 1998; Legge et al., 2001; Legge, Cheung, Yu, Chung, Lee, et Owens, in press). RSVP presents words one at a time in the same position in the visual field. However, most everyday reading requires saccadic eye movements. It is possible that a linkage between reading speed and visual-span size for RSVP reading would not generalize to reading with saccades.

Characteristics of eye-movement control may influence the relationship between visual span and reading speed for everyday reading. Legge, Klitz, and Tjan (1997) and Legge, Hooven, Klitz, Mansfield, and Tjan (2002) have formulated a computational model (BMr. Chips) to simulate saccade planning with different visual-span sizes. In general, larger visual spans predict larger saccades. On the basis of this model, we would also expect to find a close linkage between the size of the visual span and saccade-based reading speed. A secondary goal of this study was to evaluate this expectation.

To summarize, we tested three predictions: (1) visual-span size and reading speeds have the same dependence on letter spacing; (2) this association generalizes from RSVP reading to reading with eye movements; and (3) letter spacing has different limitations on reading speeds and visual spans for print sizes above and below the CPS.

(...) We found that visual-span size and reading speed had the same qualitative dependence on letter spacing and that they were highly correlated. This is consistent with the hypothesis that the size of the visual span is a front-end visual factor that limits reading speed. We now return to a question asked at the beginning of this paper – why does reading speed decrease for extrawide spacing, despite a likely reduction in crowding? Our answer, derived from our hypothesis, is that the size

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Arditi et al. (1990) have argued that crowding occurs in central vision near the acuity limit. If spacing effects are due to crowding, we would expect more pronounced spacing effects for print sizes near the acuity limit. To test this idea, Chung (2002) used two print sizes in her study: one larger and one smaller than the critical print size (CPS).

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that can be recognized reliably without moving the eyes. Legge, Ahn, Klitz, and Luebker (1997) hypothesized that shrinkage in the size of the visual span could account for slower reading for low-contrast text. They measured reading time as a function of the length of the words used in RSVP reading at different luminance contrast levels. From these reading time versus word length functions, Legge, Ahn, et al. (1997) estimated that the visual-span size decreased from 10 characters to 2 characters as contrast decreased from 100% to 5%. Legge, Mansfield, and Chung (2001) introduced a more direct method for measuring the visual span, based on plots of letter-recognition accuracy as a function of distance left and right of the midline. These plots were termed visual-span profiles. (This method is described in the Methods section.) These authors showed that visual-span profiles shrink in size in peripheral vision, potentially accounting for the corresponding decline of reading speed in peripheral vision (Chung, Mansfield, & Legge, 1998). Legge et al. (2001) also formulated a computational model that links the size of the visual-span profiles to RSVP reading speed and proposed that the size of the visual span imposes a bottle-neck on reading speed.

The concept of visual span expresses the intuitively plausible idea that reading speed is influenced by the number of letters that can be recognized on one glance; it is a kind of Bwindow size[limitation or sampling limitation on reading. This general idea has been widely accepted as a qualitative limitation on reading from the work of Javal in the 19th century, who recognized that saccadic eye

SPACING OF LETTERS IN TEXT INFLUENCES READING SPEED IN NORMAL CENTRAL AND PERIPHERAL VISION (ARDITI, KNOBLAUCH, & GRUNWALD, 1990; CHUNG, 2002; LEGGE, RUBIN, PELLI, & SCHLESKE, 1985) AND IN LOW VISION (LEGGE ET AL., 1985). INCREASING LETTER SPACING BEYOND SEPARATIONS NORMALLY FOUND IN TEXT SLOWS READING SPEED (CHUNG, 2002; LEGGE ET AL., 1985). THIS IS SURPRISING BECAUSE INCREASED LETTER SPACING REDUCES CROWDING, THE INTERFERENCE WITH LETTER RECOGNITION FROM ADJACENT LETTERS, AND IMPROVES LETTER-IDENTIFICATION PERFORMANCE (BOUMA, 1970; CHUNG, LEVI, & LEGGE, 2001). IN THIS STUDY, WE SHOW THAT THE SIZE OF THE VISUAL SPAN (THE NUMBER OF LETTERS IN TEXT THAT CAN BE RECOGNIZED WITHOUT MOVING THE EYES) CAN ACCOUNT FOR THE OBSERVED EFFECTS OF LETTER SPACING ON READING SPEED.

CHUNG (2002) MEASURED RAPID SERIAL VISUAL PRESENTATION (RSVP) READING SPEED FOR FIVE LETTER SPACINGS AT THE FOVEA AND 5° AND 10° ECCENTRICITIES IN THE LOWER VISUAL FIELD. HER RESULTS SHOWED THAT READING SPEED IN BOTH CENTRAL AND PERIPHERAL VISION DID NOT INCREASE WITH LETTER SPACING BEYOND THE STANDARD SPACING (THE SPACING USED IN NORMAL COURIER TEXT: 1.16 TIMES THE WIDTH OF THE LOWERCASE X). IN FACT, READING SPEED IN CENTRAL VISION DECLINED AT LARGER SPACINGS. LEGGE ET AL. (1985) OBTAINED SIMILAR RESULTS BY USING THE DRIFTING-TEXT METHOD. THEY MEASURED READING SPEED WITH THREE DIFFERENT LETTER SPACINGS (1X, 1.5X, AND 2X STANDARD) FOR TWO NORMAL AND FOUR LOW-VISION PARTICIPANTS.

FOR ALL PARTICIPANTS, READING

SPEED WAS HIGHEST FOR THE STANDARD SPACING AND DECREASED FOR LARGER SPACINGS.

THE VISUAL SPAN FOR READING REFERS TO THE NUMBER OF ADJACENT LETTERS THAT CAN BE RECOGNIZED RELIABLY WITHOUT MOVING THE EYES. LEGGE, AHN, KLITZ, AND LUEBKER (1997) HYPOTHESIZED THAT SHRINKAGE IN THE SIZE OF THE VISUAL SPAN COULD ACCOUNT FOR SLOWER READING FOR LOW-CONTRAST TEXT. THEY MEASURED READING TIME AS A FUNCTION OF THE LENGTH OF THE WORDS USED IN RSVP READING AT DIFFERENT LUMINANCE CONTRAST LEVELS. FROM THESE READING TIME VERSUS WORD LENGTH FUNCTIONS, LEGGE, AHN, ET AL. (1997) ESTIMATED THAT THE VISUAL-SPAN SIZE DECREASED FROM 10 CHARACTERS TO 2 CHARACTERS AS CONTRAST DECREASED FROM 100% TO 5%. LEGGE, MANSFIELD, AND CHUNG (2001) INTRODUCED A MORE DIRECT METHOD FOR MEASURING THE VISUAL SPAN, BASED ON PLOTS OF LETTER-RECOGNITION ACCURACY AS A FUNCTION OF DISTANCE LEFT AND RIGHT OF THE MIDLINE. THESE PLOTS WERE TERMED VISUAL-SPAN PROFILES. (THIS METHOD IS DESCRIBED IN THE METHODS SECTION.) THESE AUTHORS SHOWED THAT VISUAL-SPAN PROFILES SHRINK IN SIZE IN PERIPHERAL VISION, POTENTIALLY ACCOUNTING FOR THE CORRESPONDING DECLINE OF READING SPEED IN PERIPHERAL VISION (CHUNG, MANSFIELD, & LEGGE, 1998). LEGGE ET AL. (2001) ALSO FORMULATED A COMPUTATIONAL MODEL THAT LINKS THE SIZE OF THE VISUAL-SPAN PROFILES TO RSVP READING SPEED AND PROPOSED THAT THE SIZE OF THE VISUAL SPAN IMPOSES A BOTTLE-NECK ON READING SPEED.

THE CONCEPT OF VISUAL SPAN EXPRESSES THE INTUITIVELY PLAUSIBLE IDEA THAT READING SPEED

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